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[OFFICIAL NOTICE.]

To Exhibitors in Western Gas Association Display, Palace of Liberal Arts, World's Fair, St. Louis

ST. LOUIS, MO., Nov. 21, 1904.

To those Interested: The railroads made a rate of one price for round trip on all freight consigned to the Louisiana Purchase Exposition. The original bill of lading must be in the hands of shippers at this end in order to insure return of goods FREE. There is a charge of 6 cents per 100 pounds to General Service Company for loading in cases, and 10 cents per 100 pounds for terminal charges, or a total charge of 16 cents per 100 pounds. Anyone holding original bills of lading, showing amount of freight paid and the routine thereof, should put them in my hands without delay.—FRED. R. PERSONS.

[NOTICE.]

Bureau of Information, Ohio Gas Light Association.

CITY OF LINCOLN GAS CO.,
LINCOLN, ILLS., Oct. 10, 1904.

To the Fraternity: At the last meeting of the Ohio Gas Light Association a Bureau of Information was decided upon, the idea of which is to render assistance to members who may have questions coming up or difficulties arising respecting which they would like some help. This Bureau has been established and is now ready for business. A number of co-Editors have been appointed to whom the various questions will be referred. As this is the first Bureau of Information attempted by any Association, it is hoped that the members will take advantage of its opportunities. The co-Editors are as follows:

Distribution.—E. E. Eysenbach and M. E. Malone.

Accounts and Bookkeeping.—D. W. Low and Chas. Ritter.

New Business and Gas Appliances.—Frank D. Moses, Ralph Woodward and F. Cavanagh.

Chemistry—H. B. Harrop and Clarence Lomax.

Retort House.—Moses Coombs.

Natural Gas.—W. H. Hammon and Geo. W. Barnes.

All questions should be addressed to the Editor, at Lincoln, Ills.

Very truly yours,
H. L. OLDS, Editor Information Bureau.

BRIEFLY TOLD.

END OF THE "BROKEN HISTORY" FROM THE WORLD'S FAIR.—St. Louis, Nov. 28, 1904.—Dear JOURNAL: Almost by the time these disjointed notes will have reached you the World's Fair commemoration of the Louisiana Purchase will be at an end, and St. Louis will not forget the assemblage and its results for some time. Its teachings for good, especially in respect of the gas interest will be in evidence, practically and sound, for many years. The following gas men were registered "here and there" for the week ending the 26th:

A. L. Dodd, Charles City, Ia.; C. H. Seymour, Detroit, Mich.; W. P. Evans and Donald Evans, Philadelphia, Pa.; H. Maguire, Alton, Ills.; R. M. Carter, Joplin, Mo.; U. U. Foley, Chicago, Ills; L. A. Turner, Colorado Springs, Col.; C. Giorga, Florence, Italy; F. E. Marshall, Denver, Col.; A. A. Boyd, Michigan City, Ind.; G. M. Lewis, Chicago, Ills.; F. C. Shepard and John S. Welsh, Minneapolis, Minn.; A. S. Maxwell, Beatrice, Neb.; H. E. Knapp, Menominee, Wis.; Vincent Kinney, Omaha, Neb.; W. Mills, Ossawatomie, Kas.; P. M. Staller, Pittsburg, Kas.; J. H. Cunningham and J. E. Pippin, Baltimore, Md.; A. P. Lathrop, Detroit, Mich.; John Fitzgerald, Waukegan, Ills., G. M. Morris, Chicago, Ills.; Chas. L. Duncan, Gettysburg, Pa.; John H. Maxon, Elyria, O.; Grant Hornaday, Fort Scott, Kas.; W. Hamlin, Fort Wayne, Ind.; W. L. Bowers, Davenport, Ia.; J. W. R. Cullinane, Texarkana, Ark.; W. H. Barthold, Saginaw, Mich.; D. E. Walton, St. Louis, Mo.; C. H. Hinds, Le Mars, Ia.

Mrs. O. N. Guldlin was Hostess at the Indiana State Building during this month. Mr. O. N. Guldlin is an Honorary Member of the Indiana State Commission. The recognition extended to both Mr. and Mrs. Guldlin is worthy of special notice at this time. The honors to Mrs. Guldlin are the equals to those heretofore extended to Mr. Guldlin. The Board of Commissioners of Indiana, realizing that the magnificent exhibit of the Western Gas Construction Company merited some unusual distinction, the Commission, by unanimous vote, made Mr. Guldlin an Honorary Member of the Indiana Commission and presented him with a duplicate of the official badge as worn by themselves. The only other person in the State to enjoy this honor was Governor Durbin.

LIBRARY OF CONGRESS DEC SMITHSONIAN DEPOSIT.

These gentlemen are accorded all the privileges of the Commissioners themselves at the Fair. Mr. Guldlin was also selected as one of seven, out of the 1,200 exhibitors, to form up the Advisory Board of the Manufactures and Varied Industries Building, a position of honor and responsibility that few were more capable to fill. The Department of Varied Industries tendered to him the honor of an appointment as International Juror. Closing his labors here as Chairman of the Milan H. Hulburt Testimonial Fund, it can be well understood that Mr. Guldlin was busy, and he brought the gas fraternity to the front in a way never before attained by any combination of circumstances or individual efforts at a World's Fair. The end of this great Fair is in sight and the good results thereof and therefrom will be very widespread without doubt. Some time after everything is packed and shipped back to the exhibitors, perhaps I will try to tell something of the life of an attendant at an exhibition of this nature. Inadvertently in mentioning last week the awards in the Western Gas Association's exhibit in the Palace of Liberal Arts, I forgot to note that the Western Gas Construction Company received a grand prize on valves, and that a gold medal was awarded to the Inverted Incandescent Gas Lamp Company. Both of the awards were made by Group Jury, No. 26.—FRED. R. PERSONS.

AN ACKNOWLEDGMENT.—Mr. Frederick H. Shelton, under date of the 1st inst., incloses the following copy of a letter sent by him to Mr. William Cox, of this city, acknowledging the presentation to the Western Gas Association by Mr. Cox, of a set of his "Computers," shown at the World's Fair, St. Louis:

PHILADELPHIA, PA., Dec. 1, 1904.

Mr. William Cox, 25 Broad street, N. Y. city—Dear Sir: Acknowledging yours of November 29th, I think your action in donating your "Computers" to the Western Gas Association is extremely courteous and practical and will prove a help to the Association. On its behalf I wish to thank you very much. Mr. James W. Dunbar, Secretary, New Albany, Ind., is custodian of the Library, and I will ask Mr. Fred. R. Persons to send the "Computers" to him. I am also taking the liberty of inserting in the GAS JOURNALS brief reference to your courtesy.

NOTES ON THE GREEN FUEL ECONOMIZER FOR CARBURETTED WATER GAS PLANT.—We are indebted to Mr. J. Arnold Norcross, of New Haven, Conn., for the following notes contributed by the author at the last meeting of the American Gas Light Association, which notes are to be considered in connection with the papers there read by Messrs. Donald McDonald and A. B. Macbeth:

A thorough investigation of the working of the Green Fuel Economizer would be more worthy of your attention, but I venture to give you a few practical data of possible interest. The Economizer takes the blast gases from three 8-foot 6-inch water gas sets, of standard double superheater type. It feeds the boilers of the water gas plant which furnish all steam used in the manufacture of the gas up to the relief holder and for nothing else, thus giving nearly constant conditions. For the 3 months preceding the use of the Economizer the boiler fuel per 1,000 cubic feet of water gas made was 7.35 pounds of coke, of breeze and of steam coal in nearly equal portions and the screenings from the generator cleanings. The Economizer was at first used with the blast gases of only one set going through it, and so used for the 3 months following that in which it was started, the boiler fuel averaged 5.69 pounds per 1,000, or a saving of 1.66 pounds of fuel per 1,000. During the next 3 months the blast gases of 2 sets ran through the Economizer and the boiler fuel averaged 4.77 pounds per 1,000. This includes 8 days in March when the Economizer was not in use, thus showing a further saving of .92 pounds, or a total of 2.58 pounds. During the next month (April, '04) the Economizer was shut down for repairs, great difficulty being experienced in getting packings that would stand, and the boiler fuel was 6.07. Now, comparing the month of April, 1904, with the Economizer not in use, with the 3 months preceding, we find a saving by Economizer of only 1.30 pounds. This discrepancy I ascribe to no longer using generator screenings for these boilers and the use of a better quality of steam coal. In January, the quality of the fuel used being the same as in April, the average was 4.35 pounds per 1,000, or 1.72 pounds less than in April without the Economizer. Since April we have been using chiefly oil tar for boiler fuel and have no comparison of working with and without the Economizer. As a rule, we are able to feed water to our boilers at a temperature of 340° to 350° F., and the temperature of the blast gases is reduced in the Economizer to an average on a short test of 365°. There is still a large supply of waste heat left for us to save, but we believe that the above economy amply justifies the use of our economizer.

[ABSTRACT.—CONTINUED FROM PAGE 844.]

PROCEEDINGS, THIRTY-SECOND ANNUAL MEETING, AMERICAN GAS LIGHT ASSOCIATION.

HELD IN THE NEW WILLARD HOTEL, WASHINGTON, D. C., OCTOBER 19 TO 21, 1904.

SECOND DAY—FIRST SESSION.

The President called the meeting to order pursuant to adjournment, and announced that the first thing in order was the paper of Mr. B. H. Spangenberg, of Philadelphia, Pa., on the subject of

CONSUMERS' METERS.

[For the text of Mr. Spangenberg's paper see JOURNAL, Nov. 14, 21, 28. Dec. 5th, plus.]

After Mr. Spangenberg had read his paper, and before the discussion thereon, the President appointed the following as a

COMMITTEE TO AWARD THE BEAL MEDAL:

Messrs. A. C. Humphreys, E. G. Pratt and A. S. Miller. The President then invited

Discussion on the Spangenberg Paper,

and in the invitation remarked that the Association was to be congratulated upon having a paper on a subject which had hitherto not received the attention it deserved. He regarded it as a model paper upon the subject. Starting out with statements of conditions as they are, it made definite recommendations as to changes in design and resulting economies. The dollar-and-cents' end of it was very important, for decreasing the necessary investment on meters for a given capacity meant less interest charge and ultimately lower price for gas. The matter was impressed on his mind by calculations made of the difference in cost of meters, in one of our large cities, if substituted by meters described of equal capacity and less cost. This difference in cost for the city under consideration would be $459,600, a sum worth considering.

Mr. H. S. Battin, Philadelphia, said Mr. Spangenberg had presented a very strong argument in favor of standardizing consumers' meters. They were about the only articles purchased by gas companies which were not standardized, and it was time they should be. He was familiar with the method of testing followed by Mr. Spangenberg and considered his results correct. Table A was very instructive: With .3 loss in pressure the difference in capacity of meters of different makes and normal sizes was, for 3 lights, 50 per cent., for 5 lights, 58 per cent., and for 10 lights, 83 per cent. These were startling facts. Evidently the differences in design of valves were responsible for much of the differences in capacity. It was possible to make meters of a given capacity for a given size, and, from the tests of the experimental meters made by Mr. Spangenberg, it seemed possible to greatly increase capacity without increasing size of the present meter cases. Meters fitted with diaphragms which did not touch the sides and bottom, first used in 1900, had proved very successful. A 5-light meter fitted with larger channels and valves than ordinary, started September, 1899, passed 507,000 cubic feet of gas in 19 months, and upon examination proved in good condition. This was unusual service for that size, and results show that increasing the speed of the meter did not injure it, especially with the meters having free diaphragms. The capacity of any meter was limited to the amount of gas it would pass without causing fluctuation in the flame, hence the smaller sizes of meters were built and limited to a differential pressure of about .5-inch. He heartily agreed with Mr. Spangenberg in his appeal to the gas companies and meter makers to agree on a standard meter—a meter which would have a uniform capacity for a given size and differential loss of pressure.

Mr. Frederick Egner, Norfolk, Va., said he received his copy of the paper under discussion only a day before leaving for the meeting, but had read it attentively and was struck by its usefulness. Three things were particularly noticeable; the true engineering spirit in which the subject was treated, the liberality of the management which made it possible for an engineer to make such complete tests, and the fact that the meter manufacturers had left this important subject to be worked out by a customer. He thought explanations were in order from the meter makers, in spite of their acknowledged generosity and good fellowship, of the reason why they clung to the old, old way, without improvements along the lines suggested in Mr. Spangenberg's paper. He thought it a good time to inaugurate the German system of appointing commissions to investigate such subjects.

The President said he would like to see the discussion take the direction of getting the most good out of the facts presented—facts of

acknowledged value; and the question was how to make them applicable to present conditions.

Mr. Donald McDonald, Louisville, Ky., asked Mr. Spangenberg if his experiments proved anything as to the life of meter diaphragms, if run at higher speeds. He thought the life of a leather diaphragm was limited to a certain number of times it might be bent to and fro, and if it worked at higher speed the life would be shorter.

Mr. R. M. Searle, Mount Vernon, N. Y., said an experiment was now being conducted, bearing on the point made by Mr. McDonald. Six meters of the same serial numbers had been connected between the inlet and outlet of the governor, and adjusted to various rates of flow. They had been in a little over 1 year and had passed, respectively, 50,000, 100,000, 200,000, 300,000, 400,000 and 1,000,000 cubic feet. An examination of the diaphragms made about 2 months since gave absolutely no indication as to which meter had passed the most gas.

Mr. Wm. J. Serrill, Philadelphia, did not feel disposed to criticize the meter manufacturers for any supposed failure to make improvements of this kind. The consumer's meter, being the arbiter between the gas company and the consumer, should be above all things accurate. Being a delicate piece of mechanism it was dangerous to "monkey" with it. Of the 8 meters described in Mr. Spangenberg's paper, being in use from 4½ to 7½ months, the average variations from absolute corrections were about as might be expected from the same number of ordinary meters in the same length of time.

Mr. J. J. Humphreys, Jr., Coney Island, said that a meter which was limited only by the friction of the moving parts would have its accuracy more impaired by the variability of this friction, due to wear of the gland packing, than would a slow speed meter which was limited largely by the fixed resistance of the openings.

Mr. Egner hoped that some of the meter manufacturers would speak on the subject. As things were going they seemed to be "under a cloud," and if they would present their view of the matter it might prevent others from "putting their foot in it" too far.

Mr. John McIlhenny, of Philadelphia, in response to the invitation spoke in behalf of the meter as made. He said that the paper read by Mr. Spangenberg was of great interest. It portrayed a great deal of thought and expenditure of time, which provoked no feeling of hostility among the meter manufacturers They were willing to accept improvements from any source and to adopt them. However, if his hearers were in the meter business they would find new devices and new schemes for improving meters presented almost every week, and that it was impossible to keep up with them. However, when a proposition for improvement came from such an intelligent source as that traced to Mr. Spangenberg, it challenged attention, and those who made meters were more than willing to test the proposed plans; but, however, it was remembered that all over the world the like meter was used, and that for years all kinds of changes had been tried and discarded, that all attempts to speed the meter faster and make a small meter do the work of a large one had failed, any suggested change now must be carefully considered. Without intending to talk shop, he contended that the meters made in the United States, by all the meter makers, were at least equal to any made in the world, and that they were sold cheaper than any other gas meters in the world. He instanced an old employee, a meter taker, honest and faithful, who, after a hard day's work reading meters and listening to the complaints of the consumers, would come into the office in the evening, very much depressed, and say, with a sigh, "The folks are mighty suspicious of the meter." So with him, after trying many plans for improving the meter without success, he was "mighty suspicious" of any suggestion along that line. It had long been known that by speeding a meter its capacity could be increased almost indefinitely, but the meter manufacturer had always kept in view the two prime considerations—correctness and durability. Mr. McDonald, of Louisville, was right in saying there was a limit to the life of a meter. Like the human heart, it was limited in number of throbs, and the faster the heart is made to beat, either by excesses or overexertion of any sort, the shorter the life; the more deliberate the beating the longer the life. It was an average law of nature that could not be escaped that the faster a machine is kept running the sooner it is destroyed. A gas meter must be reliable and it must last 10 or 15 years. In order to cause this it must run slow. Meters can be made to run as fast as one pleased, and register as much as could be put through big openings and larger valves. The makers were willing to build those for any gas company requiring them, but to construct them so as to get the greatest possible work from them in the shortest time would be a great mistake. The whole world was standing by the present construction of the gas meter, and many law suits had been won by its accuracy. It is a splendid instrument, philosophically in its construction and beautiful in its operation. It has and does challenge the highest courts of the world to find a fault in it, and they have not been able to do so. The margin of safety, or overload, in dry meter as now constructed should be satisfactory. The normal rate for a 3-light meter was 18 feet per hour, or 3 burners consuming 6 feet each. It would easily take care of 12 to 15 burners, or 400 per cent. above the normal rate. A 5-light meter, the normal rate of which is 30 feet per hour, has a margin of safety up to about 350 per cent. All sizes have large margins. Concluding he assured the gas companies that the meter manufacturers desired to make what the companies wanted and were willing to exercise every ingenuity to that end.

The President said it was a matter of regret that the discussion should take the form of criticizing the meter manufacturers instead of being devoted to the proper direction, which was to discuss the meter itself.

Mr. William McDonald, Albany, N. Y., said he had prepared, in response to a request from the Secretary, some advance remarks on the subject which he thought were pertinent to the discussion. The subject of the paper, as one of intense interest to him, displayed much care and a great amount of work in its preparation, for which the writer was entitled to credit. Mr. Spangenberg had divided his paper into six general heads, but his real purpose centered around the second, "Present Nomenclature," the fourth, "General Character of Working Parts," and the sixth, "A Plea for Uniformity." Regarding the nomenclature of meters there had been considerable discussion, and it might be that a change to some other method would be better. Should the present rating be changed the only other thing to be done would be to place on the meter the number of cubic feet per hour it was designed to pass at a given loss of pressure. This could not be done with accuracy, as shown by the tables prepared by Mr. Spangenberg. Meters made by the same house, under exactly the same conditions, with the same kind of working parts, and handled with the same care, showed a large variation between their maximum and minimum capacity at the 3-tenths, 4-tenths and 5-tenths loss, this being particularly noticeable in the tests under the 3-tenths. One could then readily see that whatever the rating might be it must be low enough to cover all contingencies, and if a manufacturer rated his meter as passing 100 feet per hour under a given loss in pressure he must not send out one which would not pass this amount. The summary, Table A, in the paper, showed that the meters averaged up to the present ratings under a 3-tenths loss in pressure, save three or four exceptions. However, any plan of rating which commended itself to the manufacturers and satisfied the users would be satisfactory to the speaker. Regarding the fourth division, "General Character of Working Parts," there was a considerable difference between Mr. Spangenberg's ideal and the speaker's. Turning to Table A, showing tests of fifty 3-light meters, it can be observed that meter No. 49 passed only 15.6 feet per hour under a 3-tenths loss, whereas the general average of the meters of this maker showed 40.91 feet per hour with the same loss. Again, this meter more than doubled its capacity at 4-tenths loss, and nearly doubled it again at 5-tenths, just about quadrupling it from 3-tenths to 5-tenths, while the average capacity of the meters tested did not double from 3-tenths to 5-tenths loss. This prevailed, to a greater or lesser extent, all through the tables. Now, why did this particular meter pass so little at 3-tenths loss and increase so rapidly up to 5-tenths? Evidently there was some restraining influence. It was not friction probably, but that which a meter maker would term "dirty valves." While that might be an extreme instance the same thing prevailed throughout the tables, being especially marked in Table F, where a test of 3-light experimental meters was given, in which there was about 50 per cent. difference between the maximum and minimum flow under 3-tenths loss of pressure. If this were a difficulty easily avoidable Mr. Spangenberg would have kept it out of his experimental meters. Referring to the experimental meters one thing in particular was worthy of attention. The average amount passed per hour by the experimental 5-light meter was given as 218.6 feet, with 5-tenths loss. This would cause about 30 revolutions of the crank per minute, presuming the meter geared to 8 turns per foot, which was double the speed at which any meter should run under any circumstances. The meter makers had never been convinced of the desirability of running meters at such speed. Mr. Spangenberg evidently advocated smaller diaphragms and larger valves, also larger channels. Since the channels need be only large enough to supply the valves and diaphragms they might be left out of the question. Smaller diaphragms and larger valves would necessitate a longer stroke of the crank, and would militate against the two cardinal principles which the meter maker has to observe. First, accuracy; second,

durability, and the plan proposed by the writer of the paper would greatly increase the difficulty of maintaining these two principles. Any deposit from the gas while the meter was in use, which retarded the motion of the valve, would of necessity be greater on a large valve than on a small one, and with a smaller diaphragm there would be very much less power available to drive the meter. Hence it would be impossible to keep a meter in order, or reasonably accurate for any length of time, which is constructed along such proposed lines. While various makers had enlarged the channels from time to time, they were reluctant to increase the area of the valve ports, and had always tried to keep the diaphragm as large as possible. A careful study of the action of meters when in *use* would prove that these ideas were well founded. By his plea for "Uniformity" Mr. Spangenberg gained sympathy, and if it could be secured it would benefit both the manufacturers and the users of meters The whole question presented a most difficult problem, to a solution of which the manufacturers had given their best efforts. While improvements were not impossible, the paper advocated them along lines which would entail grievous errors, affecting permanently, not only the average accuracy of dry meters, but decreasing seriously their lasting qualities.

Mr. John Gribbel, Philadelphia, said the paper just listened to deserved the highest commendation, both for the manner in which the subject was approached and for the carefulness with which it was prepared. It was gratifying to the meter maker to have such co-operation on the part of a meter user, for it was by such joint labor that the best results were obtained. The nomenclature, he thought, should be decided by the gas engineer, since it was immaterial to the manufacturer how the different sizes should be called. There would be no objection to designating meters by ordinary numbers, or by the number of cubic feet of their normal capacity. He thought it very essential that the present external dimensions should be preserved, since a change in them would cause expense and trouble to both user and maker, the maker's portion being by far the smaller. He agreed with the statement that full sheepskin was by far the best material known for meter diaphragms and careful observations, covering an experience of 25 years, had convinced him that this leather should be carefully selected, beginning with the animal itself and carried along, stage-by-stage, through each succeeding process in its manufacture. If, out of a quantity of raw skins of average quality, 10 per cent. of perfect diaphragm leather was secured, the result should be called satisfactory, except to those who know how to use more. If stuffing boxes should be made longer, to meet a pressure of 2 to 4 pounds, as suggested in the paper, the gas engineer must be prepared for larger differentials in pressure for given capacity than stated. It should be remembered that the bearings of the flag-arms, controlling the tangent whereby the valve crank is operated, are dry bearings, and from their location necessarily so. Even if the bearing surfaces should be increased, no provision could be made for their lubrication. He could not see any possibility of a resistance of 5 tenths inch bending any of the present flag wires in use. He thought the lines upon which the experiments were so carefully made by Mr. Spangenberg diverged at a very wide angle from those which the manufacturers considered safe and desirable. They had been educated, by generations of gas engineers, to consider two features in a meter of paramount value: First, its accuracy of registration; second, the length of its life of usefulness. Should they in future follow the lines suggested in the paper, namely, maximum hourly capacity in a certain given cubical area of the meter. then they must not be held to the standards of accuracy and length of life in the meter heretofore required. There might be a middle ground which the gas engineer, by future experiments, might conclude most advantageous for him, but one thing they must all realize—he must modify former requirements. He thought that increasing the speed of the meter could only be done at the sacrifice of something else, and that it was with the gas engineer to determine what that should be.

Mr. Charles H. Dickey, Baltimore, said he had listened to the remarks made by those engaged in meter manufacturing and he did not agree with them in all things. He thought, and had been confirmed in the thought by a few experiments, that the meter as made to-day could be made of better service to the gas companies. He thought a 5-light meter could be constructed on some such basis as suggested by Mr. Spangenberg, which would give larger capacity; but the protection necessary for such a meter would be that it should not be *overworked*. If a 5-light meter could be made to pass 250 feet per hour on 2 inches pressure, and with a differential of 3-tenths, above which it should not be worked, it should pass 100 feet per hour, that meter ought not on any occasion be required to register over the 100 feet per hour. As suggested by Mr. Doherty, there should be a check so that when the consumer was using over 100 feet an hour he would cry out that he was not getting gas enough. In that way the life of the meter would be prolonged. He thought the nine sizes of meters now in use, running from 3-lights up to a 100-lights, might be reduced to four or five sizes which should have a given record under a given pressure, say 2 inches, and be calculated to pass so many 100 feet under a differential of 3-tenths, such capacities to be stamped on the meters. For instance, a size corresponding with the 5-light meter to have a capacity of 250 feet per hour under 2 inches pressure, and to pass 100 feet per hour, with a differential of 3 tenths, which would be good for 20 burners at 5 feet per hour. The next size, say, to register 350 feet on the 2 inches pressure, and passing 140 feet under the 3-tenths differential, and so on up "the line." Gas companies would then know just what size to take from stock to fit any given service where the meter was to set.

Mr. John D. McIlhenny, Philadelphia, thought Mr. Spangenberg's paper the best that had been presented on the subject of the consumers' gas meter. The question of increased capacity had been brought about by the changed conditions of the business itself. Until recently the use of gas was restricted to lighting and the demands for gas through meters comparatively small; but now that gas was used for lighting, cooking, heating water, heating rooms and other uses, requiring large quantites at certain hours and at others a minimum amount, how were these conditions to be met? By using large meters running at a slow rate as heretofore, or by putting in meters that could run rapidly? That question the gas companies' office force must decide. As manufactured to-day the gas meter is the most accurate instrument of measurement in the world, surpassing the best watch movement, and the gas meter is subjected to more trying times than that to which any watch was ever subjected. Placed at the top of a room over a steam radiator or in a damp and cold cellar, never oiled, but working month in and month out, tested once in 3 years, or even at longer intervals, still we know that it is depended upon to give accurate registration during the days of trial and for proof. In cases where thousands of meters were tested in 1 year the average error of registration was less than 1 per cent. slow. The meter has, and should have, a large margin of safety. To set one at its maximum capacity is unwise, for the consumer will add more burners and gas appliances from time to time, and in view of this the meter should have a large margin of safety to which it can go without injury, without causing the gas company additional expense in frequent changes, and without causing the consumer annoyance. He agreed with the other meter makers who had spoken on the subject, in that meters should be run moderately and not overtaxed. The average 5-light meter as now constructed made about 8 revolutions per minute at maximum speed. The experimental meter described in the Spangenberg essay ran at the rate of 29 to 30 revolutions per minute—an increase of 3 times; but was it wise to run meters at 3 times their present speed? Meters in use have contended with all sorts of things, but the chief cause for repairs comes from condensation. There are varied forms of condensation. One is of a light, oily sort that really does not harm the meter; rather benefits it. In other cases the condensation is "sticky," and that is bad. Again, the gas is dry and accompanied with gritty particles, than which there is nothing worse. Much money can be saved gas companies by reducing the amount of condensation in the gas before the gas reaches the meters, which should in no sense be considered drip pots. In the early days of natural gas it was sold at high pressures, and a meter made of cast iron was thought necessary. Nearly all of these were made to run rapidly, with many revotutions to a cubic foot and many revolutions to a minute. Every one of that style had proven a failure, and the great bulk of them have been sold by the natural gas companies for "scrap," along with some others. While the meter manufacturers, and the gas companies as well, are jealous of introducing anything which cannot be relied upon, possibly they were mistaken and the high speed meter might prove to be all right; but before putting out new styles, proper trial of them should be made. One year was not a sufficiently long time for a gas meter test. He suggested that some large company might make a few thousand meters such as were described in the paper and put them in use for a few years. If they then proved satisfactory the manufacturers would not object to making that kind. Referring to the life of the leather diaphragm, of which Mr. McDonald spoke, he had never seen one which actually wore out from the work fairly imposed upon its "capacity."

The President here announced, as the time for recess had not only been reached but passed, that the discussion on the Spangenberg paper would be the first order for the afternoon. He then recognized Mr A. C. Humphreys, who claimed a

HEARING ON SPECIAL ACCOUNT.

Mr. Humphreys said he appreciated the fact that the hour for adjournment had passed, but craved the indulgence of the meeting for a moment. He reminded the members that, upon the adjournment of the meeting, Mr. A. E. Forstall would retire from the office of Secretary-Treasurer, which dual place he had occupied for 8 years with credit to himself and to the satisfaction of the Association. He thought the success of such an Association depended largely upon the measure of ability, industry and faithfulness displayed by the occupant of that office, and that the Association had been fortunate in its Secretaries, and peculiarly so in having secured and held the services of Mr. Forstall for so long a period of time, only one other Secretary having equaled it. He presumed the election of Mr. Forstall as Third Vice-President of the Association was in acknowledgment of his services as Secretary-Treasurer, and also to retain his services for a further period on the Council of Governors and later as President. However, it seemed to many of Mr. Forstall's friends in the Association that some more material expression of their approval of his career should be made. Those first in charge of the matter turned toward the selection of something beautiful to the eye, but, having in mind the man, it was seen at once that it would be proper to have that expression in a form simple, useful and sterling. He was always very conscious of the feebleness of his speech, but on this occasion he was not sorry that he had been selected to express to Mr. Forstall the thought his associates had for him, and if his own speech were feeble he could claim it was sincere. He had personally known Mr. Forstall's father, a man universally admired and a former President of this Association. He looked up to him with reverence and with pride in his acquaintance. He admired Mr. Theobald Forstall for the beautiful simplicity of his character, joined to his magnificent ability as a gas engineer, and he felt he could not better express his feelings with regard to Mr. A. E. Forstall than to say he proved a worthy son of such a man. He then presented Mr. Forstall with a life membership in the Association and a box containing a beautiful silver service.

In accepting the offering, Mr. Forstall said he would have to take back his statement of yesterday, in which he said he thought he "deserved all he got." Throughout the years of his service as Secretary of the Association he had been painfully conscious of how far short he had fallen respecting the manner in which that position should be filled, and he was overwhelmed by the testimonial that his friends in the Association did not agree with him in this feeling. He could only account for it by the thought that they knew less about it than he. He thanked the Association for its life membership certificate and his friends for their beautiful gift, and regretted that he could not make a speech fitting his thoughts over both.

A recess until 2:30 P.M. was ordered.

[To be Continued.]

Naphthaline Removal.[1]

By MR. WILLIAM YOUNG.

In the editorial comments upon my communication which appeared in your issue of the 25th Oct., you kindly gave credit to my colleagues and self for our labors in connection with the naphthaline problem—personally, I feel, to an extent much greater than deserved. You further kindly remark that, so far as you know, no one had questioned the validity of the claims for novelty of what is known as the Young and Glover naphthaline process; and you put the question "What does the process compass?" Further, while drawing attention to the main object, you also kindly credit my communication with having infused into it an interest which brings into relief its educative side in a way that will be helpful to all those who are working in the direction of applying the results of the labors of my colleagues and self, and to those who are pursuing the work with the view of further developments. I have to thank you again for these highly appreciated comments upon the motives prompting my contribution on the subject; they are in full accord with the truth. My labors in connection with the evolution of the solution of the naphthaline problem were labors for the love of the subject, a recreation, a pleasure, and were not undertaken with the object of the pecuniary gain they might possibly bring to me.

The Young and Glover naphthaline process was not, however, the outcome of my labors alone. All that I contributed was that of my past experience and advice. My colleagues, the Messrs. Glover, had all the drudgery and labor connected with making themselves conversant with the principles connected with my life experience. They carried out the drudgery of the experimental work, and the practical application of that work on the practical scale in their own and other works; and I would be very pleased indeed if they, or even I, should be rewarded with something more tangible than that of the credit of being scientific pioneers in the solution of the naphthaline problem. You had evidently entertained somewhat similar views, as is borne out by the gist of your remaining editorial comments; and I wish to refer more particularly to your remark to the following effect: "If the Young and Glover patent covers the Bell, Colson, and any other application of oil washing for the elimination of naphthaline from gas, then it follows that Messrs. Young and Glover are entitled in connection with them to something more tangible than credit." Then, again: "Where patents are concerned, people do not like uncertainty; and a very useful system may suffer in application from doubts in this regard." To avoid such a contingency arising from the cause to which you refer, and also others that have arisen during the correspondence that has taken place on the subject, is my motive for making this further communication bearing upon the matter.

Your pages are not the proper place to discuss the legal aspect of the case; and I will, as far as possible, avoid doing so. It is necessary, however, that I should make some frank explanations regarding the legal document—the specification of the Young and Glover patent. Practically, I am responsible for the matter in the body of the specification descriptive of the process which it claims, as it stands almost as I drafted it, and as it was approved of by my colleagues and our patent agent. Every effort was made as clearly as possible to explain in what the process consisted. The claims may be good or bad; but they were practically left in the hands of the highly skilled patent agent employed by us. In my former contribution, I also tried to clearly explain, by quotations from the specification, the nature of the Young and Glover process; and the three short quotations to which you referred in your editorial fairly clearly showed what was intended should be claimed. If these claims are wrong, they can be amended; the descriptive matter of the body of the specification could not.

To have a sound conception of whether or not the process described in the Young and Glover patent was novel and whether the claims made were such as to be sound legal ones, it is necessary to have a wide knowledge of previous well-known facts relating to the subject. One of my earliest experiences of the difficulties arising from naphthaline was in connection with the application of the Aitken and Young analyzing or condensing process as applied to the treatment of the gas from Newcastle coals. This process consisted in making the condensed tars to flow backwards over a series of shelves against the flow of gas from the retorts, the lower of these shelves being heated. The object of the process was to remove the tars from contact with the gas as they were deposited, and prevent them dissolving the benzol and other illuminants out of the gas; and the heating of the lower shelves was to revolatilize out of the tar any benzol or other volatile hydrocarbon vapor that the tar might have taken up in solution. The arrangement or process effected its object most effectively—in fact, it acted so well that it not only loaded the gas with all the benzol and other hydrocarbons that would have been left in the tar, but it also loaded it with naphthaline vapors, with the result that the terminal chambers of the arrangement and other mains got blocked up with beautiful white masses of solid crystalline naphthaline.

Attempts were made to restrict the process so as to volatilize the benzol and other light hydrocarbons into the gas without also loading it with naphthaline. But it was found impossible to do so, as the same conditions which allowed the naphthaline vapors to be retained in solution in the tar also enabled the tar to dissolve out parts of the illuminating benzol vapors. The process was thus shown to be unsuited for the treatment of Newcastle coal gas. This was common knowledge nearly 30 years ago. Therefore we knew that coal tar, or rather the hydrocarbons in the coal tar, had a solvent affinity for the hydrocarbon vapors present in coal gas, including those of naphthaline; and this knowledge has since been the guiding principle in all condensing arrangements. The effort has been made in various ways to restrict the solvent affinity of the tar for the benzol and other illuminating vapors of volatile liquids, as far as possible consistent with allowing the tars to absorb the naphthaline—a compromise between the two opposing actions; and under such conditions it is impossible with Newcastle and similar coals to get the tars to remove all the naphthaline from the gas.

The other process of which I had experience about the same time was that alluded to in my former contribution—the washing of shale gases with liquid hydrocarbon solvents to absorb from these gases the vapors of volatile hydrocarbon that could not be reduced to the liquid state by cold in condensers. The process consisted in continually pump-

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ing into the top of a scrubbing tower up through which the gas to be scrubbed was passed, a quantity of heavy oil, which, in its passage downwards, absorbed the hydrocarbon vapors from the shale gas. The washing oil, charged with the absorbed vapors, passed to a column still, up through which steam was passed, which distilled out of the heavy oils the vapors which they had absorbed. These vapors, condensed into naphtha, containing hydrocarbons having different boiling points—the most volatile boiling at the temperature of the air, the least volatile considerably above the boiling point of water. By these means we could remove all the vapors from the gas; but in order to do so, it was necessary to use a certain quantity of oil in relation to the gas to be washed. If the quantity fell short of that necessary, the gas passed away still charged with some vapors.

Now I observed—and I have no doubt others have done the same—when the supply of oil was short of that needed, it did not continue to take out a proportion of all the vapors present in the shale gas, but the oil absorbed in greater proportion the vapors having the lowest tension; and the resulting recovered naphtha had a higher specific gravity, and the hydrocarbons a higher boiling point. On occasions when the column still had to be temporarily bye-passed, and the oils continued to be circulated through the scrubber, I observed that the heavy oils continued to absorb the least volatile vapors out of the shale gas, and even to continue to do so, and at the same time give up to the gas the more volatile vapors it had previously absorbed.

These facts might be common knowledge—I have no doubt they were—but the only use to which they had been applied prior to the Young and Glover process had been to devise the best means possible to get the smallest quantity of heavy oil to most effectively absorb the whole of the vapors from the gas.

(To be Continued.)

(Continued from Page 848.)

Consumers' Meters.

[A paper prepared for and read at the Thirty-second Annual Meeting of the American Gas Light Association, by MR. B. H. SPANGENBERG, Philadelphia, Pa.]

TABLE "A."

Showing the Test of Fifty 10-*Light Meters of Maker No.* 1.

Meter Tested, No.	Capacity per Hour Under Loss of Pressure of 3-10 In.	4-10 In.	5-10 In.	Meter Tested, No.	Capacity per Hour Under Loss of Pressure of 3-10 In.	4-10 In.	5-10 In.
1	85.80	109.80	123.60	26	90.00	109.80	126.00
2	88.20	102.00	118.20	27	88.20	108.60	126.60
3	92.40	107.40	123.60	28	90.00	107.40	123.60
4	87.00	110.40	126.00	29	87.00	111.00	128.40
5	81.60	109.20	126.00	30	82.20	108.60	124.80
6	79.80	105.00	124.20	31	90.00	*114.00	129.00
7	76.80	100.20	122.40	32	88.20	106.80	122.40
8	80.40	97.20	117.60	33	85.80	108 00	126.00
9	†68.40	†92 40	†117.00	34	91.20	110.40	130.80
10	78.00	100 80	117.60	35	76.80	102.60	120.00
11	77.40	104.40	122.40	36	83.40	109.20	126.00
12	75.60	99.00	118.80	37	81.00	106.80	124.80
13	86.40	106.20	123.00	38	82.20	108.60	126.00
14	78.60	100.80	121.20	39	92.40	114.00	*132.00
15	77.40	102.60	122.40	40	89.40	107.40	123.60
16	76.80	102.60	121.80	41	91.80	112.80	130.80
17	80.40	103.20	121.20	42	88.20	106.20	123.60
18	82.20	109.80	127.20	43	87.00	105.60	123.60
19	80.40	105.00	124.80	44	88.80	112.20	129.00
20	80.40	109.80	125.40	45	87.00	111.60	128.40
21	86.40	111.00	128.40	46	87.00	110.40	127.20
22	86.40	103.80	124.80	47	84.00	107.40	124.80
23	88.20	108.60	127.80	48	86.40	102.60	117.00
24	*94.80	112.20	129.00	49	82.80	108.60	124.80
25	90.60	106.20	124.20	50	84.60	106.20	123.60
	2,054.40	2,619.60	3,079.20		2,165.40	2,716.80	3,142.80
Totals of first half					2,054.40	2,619.60	3,079.20
Grand total					4,219.80	5,336.40	6,222.00
Average capacity per hour per meter					84.40	106.73	124.44
*Maximum " " any "					94.80	114.00	132.00
†Minimum " " " "					68.40	92.40	117.00

Average temperature, 81° F.

TABLE "A."

Showing the Test of Fifty 10-*Light Meters of Maker No.* 2.

Meter Tested, No.	Capacity per Hour Under Loss of Pressure of 3-10 In.	4-10 In.	5-10 In.	Meter Tested, No.	Capacity per Hour Under Loss of Pressure of 3-10 In.	4-10 In.	5-10 In.
1	93.00	113.40	129.60	26	93.60	114.60	126.90
2	87.00	108.60	127.20	27	75.60	99.60	122.40
3	90.00	112.20	128.40	28	81.00	107.40	121.80
4	87.60	106.80	126.60	29	85.80	108.60	127.20
5	79.80	99.60	121.80	30	81.00	102.00	124.80
6	78.00	102.60	124.80	31	74.40	102.00	120.00
7	75.00	101.40	124.80	32	78.00	99.00	122.40
8	76.20	99.60	120.00	33	84.00	105.00	120.00
9	85.20	108.60	123.60	34	84.60	110.40	123.00
10	79.20	103.20	125.40	35	85.20	108.00	120.00
11	78.00	102.60	124.80	36	93.00	113.40	130.20
12	*94.80	*115.20	*136.20	37	87.00	108.00	126.60
13	88 20	105.00	126.00	38	87.00	108.00	127.20
14	87.60	107.40	127.80	39	84.00	107.40	126.00
15	74.40	102.00	118.20	40	78.60	102.60	124.80
16	75.00	102.00	120.00	41	88.20	109.20	130.80
17	†73.80	†98.40	†117.00	42	84.60	108.60	130.80
18	75.60	102.00	120 60	43	94.20	114.60	132.00
19	74.40	99.00	117.60	44	89.40	111.60	130.20
20	76.20	100.80	120 00	45	87.00	109.20	128 40
21	77.40	105.00	126.60	46	79.80	107.40	126.00
22	81.00	106.80	121.20	47	85.20	108.00	127.20
23	75.00	99.00	117.00	48	93.00	113.40	128.40
24	75.60	102.00	118.80	49	88.20	108.00	127.80
25	83.40	106.20	124.80	50	87.00	109.20	127.20
	2,021.40	2,609.40	3,088.80		2,129.40	2,695.20	3,154.80
Totals of first half					2,021.40	2,609.40	3,088.80
Grand total					4,150.80	5,304.60	6,243.60
Average capacity per hour per meter					83.02	106.09	124.87
*Maximum " " any "					94.80	115.20	136.20
†Minimum " " " "					73.80	98.40	117.00

Average temperature, 77° F.

TABLE "A."

Showing the Test of Fifty 10-*Light Meters of Maker No.* 3.

Meter Tested, No.	Capacity per Hour Under Loss of Pressure of 3-10 In.	4-10 In.	5-10 In.	Meter Tested, No.	Capacity per Hour Under Loss of Pressure of 3-10 In.	4-10 In.	5-10 In.
1	90.60	114.00	133.20	26	91.20	117.00	135.00
2	93.60	106.80	132 00	27	100.20	120.60	138.00
3	†90.00	118.80	135.60	28	99.60	120.00	138.00
4	103.20	120.60	140.40	29	96.00	117.00	137.40
5	92.40	115.80	133.80	30	99.00	120.60	138.00
6	90.60	114.60	132.00	31	91.20	107.40	129.60
7	96.60	117.60	137.40	32	90.60	115.20	135.60
8	100.20	121.20	138.00	33	97.20	113.40	135.00
9	99.00	120.00	137.40	34	95.40	116.40	136.80
10	108.00	124.80	139.20	35	102.60	120.60	141.00
11	96.00	113.40	135.00	36	103 80	121.20	144.00
12	91.20	104.40	128.40	37	104.40	123.00	144.00
13	91.20	113.40	132.60	38	103.20	120.60	144.00
14	99.00	115.80	135.00	39	101.40	118.80	142.20
15	99.00	118.80	136.80	40	98.40	117.60	138.00
16	90 60	†103.20	†128.40	41	101.40	120.00	141.00
17	92.40	105.00	130.20	42	102.60	119.40	140.40
18	91.20	117.00	135.60	43	108.60	*128.40	*146.40
19	95.40	117.00	136.80	44	*109.20	123.60	146.40
20	96.60	117.00	136.20	45	103.20	120.60	145.80
21	95.40	117.00	136.20	46	104.40	121.80	144.00
22	96.00	114.00	135.60	47	99.60	118.80	141.60
23	94.80	116.40	137.40	48	106.80	124.80	146.40
24	96.00	117.00	136.80	49	102.00	119.40	143.40
25	94.80	116.40	136.80	50	99.60	117.60	141.60
	2,393.80	2,880.00	3,376.80		2,501.60	2,983.80	3,513.60
Totals of first half					2,393.80	2,800.00	3,376.80
Grand total					4,895.40	5,863.80	6,890.40
Average capacity per hour per meter					97.91	117.28	171.81
*Maximum " " any "					109.20	128.40	146.40
†Minimum " " " "					90.00	103.20	128.40

Average temperature, 79° F.

TABLE "A."

Showing the Test of Fifty 10-Light Meters of Maker No. 4.

Meter Tested, No.	Capacity per Hour Under Loss of Pressure of 3-10 In.	4-10 In.	5-10 In.	Meter Tested, No.	Capacity per Hour Under Loss of Pressure of 3-10 In.	4-10 In.	5-10 In.
1	98.40	120.00	144.00	26	102.00	117.00	140.40
2	96.00	120.00	142.80	27	97.80	117.00	136.80
3	96.00	120.60	142.80	28	100.80	119.40	133.80
4	†93.60	119.40	142.20	29	97.80	120.60	143.40
5	98.40	†111.00	†132.00	30	100.20	124.20	144.00
6	95.40	120.00	144.00	31	100.20	117.00	137.40
7	102.60	117.00	139.20	32	97.80	120.60	144.00
8	100.80	111.00	144.60	33	100.80	121.80	144.00
9	99.00	120.00	133.20	34	98.40	115.80	136.80
10	105.60	123.60	147.00	35	101.40	117.00	139.20
11	102.00	120.00	145.20	36	102.60	119.40	139.80
12	94.80	120.00	141.00	37	99.60	121.80	144.60
13	96.00	120.00	144.00	38	95.40	120.60	141.60
14	98.40	120.00	144.00	39	96.60	119.40	142.20
15	97 20	120.00	143.40	40	99.00	118.80	133.80
16	101.40	116.40	139.20	41	102.60	118.80	143.40
17	96.60	120.60	142.80	42	96.60	116.40	139.20
18	102.00	116.40	138.60	43	96.00	118.20	141.60
19	96.60	121.20	142.80	44	102.00	121.80	145.80
20	102 60	116.40	139.80	45	99.60	120.60	144.00
21	*106.20	122.40	*147.00	46	95.40	117.00	135.00
22	99.00	*124.80	144.60	47	101.40	114.00	1a3.40
23	99.00	121.20	143.40	48	99.00	118.20	141.00
24	94.80	119.40	141.00	49	94.80	116.40	135.60
25	99.60	124.20	144.00	50	97.80	120.60	142.80
	3,472.00	2,985.60	3,552.60		2,475.60	2,972.40	3,513.60
Totals of first half					2,472.00	2,985.60	3,552.60
Grand total					4,947.60	5,958.00	7,066.20
Average capacity per hour per meter					98.95	119.16	141.32
*Maximum " " any "					106.20	124.80	147.00
†Minimum " " " "					93.60	111.00	132.00

Average temperature, 79° F.

TABLE "A."

Showing the Test of Fifty 10-Light Meters of Maker No. 6.

Meter Tested, No.	Capacity Per Hour Under Loss of Pressure of 3-10 In.	4-10 In.	5-10 In.	Meter Tested, No.	Capacity Per Hour Under Loss of Pressure of 3-10 In.	4-10 In.	5-10 In.
1	130.20	151.20	171.00	26	117.00	146.40	174.60
2	122.40	146.40	170.40	27	115.80	145.20	168.00
3	123.00	148.20	165.60	28	115.80	144.60	170.40
4	124.80	145.80	169.80	29	116.40	142.80	172.20
5	120.00	146.40	169.20	30	112.80	144.00	166.80
6	126.00	152.40	174.00	31	109.20	142.80	175.20
7	123.00	148.80	168.60	32	116.40	144.60	178.80
8	127.20	150.60	171.00	33	115.20	143.40	174.00
9	122.40	148.80	169.20	34	124.80	145.80	179.40
10	122.40	148.20	168.00	35	132.00	148.20	178.80
11	118.80	144 60	166.80	36	*133.80	148.80	180.00
12	116.40	†142.80	169.20	37	122.40	148.80	169.20
13	109.80	144.00	168.00	38	130.20	150.00	176.40
14	†103.20	146.40	163.80	39	114.60	144.00	170.40
15	111.00	148.20	168.00	40	122.40	145.20	170.40
16	112.80	142.80	168.00	41	124.80	148.20	172.20
17	124.80	146.40	175.80	42	126.60	151.80	176.40
18	124.80	145.20	177.60	43	126.00	153.00	175 20
19	110.40	144.60	171.00	44	124.80	*153.60	169.80
20	126.60	149.40	177.00	45	124.80	152.40	174.60
21	115.20	143.40	166.80	46	124.20	153.60	175.20
22	120.00	144.60	169.20	47	124.80	153.00	169.80
23	128.40	153.00	180.00	48	124.20	149.40	172.20
24	127.20	148.80	177.60	49	125.40	148.20	172.80
25	115.20	144.00	†162.00	50	124.80	147.00	172.80
	3,006.00	3,675.00	4,257.60		3,049.20	3,694.80	4,335.60
Totals of first half					3,006.00	3,675.00	4,257.60
Grand total					6,055.20	7,369.80	8,593.20
Average capacity per hour per meter					121.10	147.40	171.86
*Maximum " " " any "					133.80	153.60	180.00
†Minimum " " " " "					103.20	142.80	162.00

Average temperature, 76° F.

TABLE "A."

Showing the Test of Fifty 10-Light Meters of Maker No. 5.

Meter Tested, No.	Capacity Per Hour Under Loss of Pressure of 3-10 In.	4-10 In.	5-10 In.	Meter Tested, No.	Capacity Per Hour Under Loss of Pressure of 3-10 In.	4-10 In.	5-10 In.
1	91.20	110.40	130.80	26	83.40	99.00	123.60
2	87.00	*111.00	*130.80	27	84.00	105.00	122.40
3	83.40	105.60	121.80	28	83.40	99.00	120.00
4	84.00	99.00	123.60	29	84.60	107.40	127.80
5	81.00	99.00	120.00	30	81.60	104.40	126.60
6	83.40	105.00	124.80	31	78.00	104.40	124.80
7	†76.20	104.40	125.40	32	84.60	99.00	120.00
8	81.60	104.40	126.60	33	84.00	101.40	120.00
9	84.60	108.00	128.40	34	84.00	107.40	128.40
10	84.60	105.00	124.80	35	85.80	108.00	128.40
11	81.00	103.20	124.20	36	80.40	†96.00	†117.00
12	82.20	105.60	125.40	37	84.00	102.60	121.20
13	80.40	103.20	120.00	38	84.00	106.80	128.40
14	84.00	107.40	128.40	39	81.00	104.40	126.00
15	82.20	103.80	126.00	40	83.40	99.60	123.00
16	83.40	107.40	127.80	41	84.60	107.40	127.80
17	80.40	105.00	126.00	42	85.80	110.40	129.00
18	*91.80	109.80	130.80	43	81.00	103.20	126.00
19	85.80	99.00	124.80	44	90.60	109.80	129.00
20	85.80	107.40	129.00	45	90.00	110.40	130.20
21	84.60	108.00	128.40	46	85.80	108.60	128.40
22	81.60	99.60	120.00	47	90.60	109.80	129.00
23	82.80	104.40	124.80	48	87.60	103.80	126.00
24	81.00	96.60	117.60	49	88.80	103.80	126.60
25	78.60	105.00	126.00	50	84 00	98.40	121.20
	2,082.60	2,617.20	3,136.20		2,115.00	2,610.00	3,130.80
Totals of first half					2,082.60	2,617.20	3,136.20
Grand total					4,197.60	5,227.20	6,267.00
Average capacity per hour per meter					83.95	104.54	125.34
*Maximum " " any "					91.80	111.00	130.80
†Minimum " " " "					76.20	96.00	117.00

Average temperature, 80° F.

TABLE "A."

Showing the Test of Fifty 10-Light Meters of Maker No. 7.

Meter Tested, No.	Capacity Per Hour Under Loss of Pressure of 3-10 In.	4-10 In.	5-10 In.	Meter Tested, No.	Capacity Per Hour Under Loss of Pressure of 3-10 In.	4-10 In.	5-10 In.
1	112.20	138.00	172.80	26	123.00	149.40	171.60
2	115.20	148.20	167.40	27	114.60	142.80	172.20
3	123.60	149.40	168.00	28	120.60	148.20	171.60
4	*126.00	150.00	169.80	29	119.40	149.40	168.00
5	112 80	145.80	164.40	30	112.80	142 80	*161.40
6	111.60	146.40	162.00	31	112.20	145.80	165.60
7	109.20	†133.80	168.00	32	111.60	146.40	162.00
8	†107.60	138.00	166.80	33	114.00	145.80	163.20
9	111.00	145.20	164.40	34	111.60	143.40	165.60
10	120.00	146.40	166.20	35	114.00	141.60	163.20
11	112.80	135.00	165.60	36	119.80	148 20	168.00
12	114.60	148.80	168.60	37	113.40	139.80	165.60
13	124.80	*151.20	170.40	38	122.40	148.20	168.60
14	124.20	150.60	171.60	39	116.40	145.20	164.40
15	115.20	149.40	168.00	40	112.80	142.80	163.20
16	114.60	148.80	166.80	41	115.20	148.20	163.80
17	115.80	147.60	167.40	42	114.60	147.60	167.40
18	112.80	145.80	165.00	43	109.80	139.80	166.20
19	121.80	150.00	169.20	44	119.40	150.00	171.00
20	116.40	147.00	169.20	45	114.00	146.40	172.20
21	111.60	147.00	165.00	46	120.60	148.80	168.60
22	110.40	140.40	166.80	47	112.80	145.20	165.00
23	112.20	144.60	162.00	48	114.00	147.60	*175.20
24	122.40	150.00	171.60	49	114.00	146.40	166.20
25	115.80	148.20	168.60	50	113.40	145.80	165.60
	2,894.60	3,645.60	4,185.60		2,886.40	3,645.60	4,175.40
Totals of first half					2,894.60	3,645.60	4,185.60
Grand total					5.781.00	7,291.20	8,361.00
Average capacity per hour per meter					115.62	145.82	167.22
*Maximum " " " any "					126.00	151.20	175.20
†Minimum " " " " "					107.60	133.80	161.40

Average temperature, 81° F.

TABLE "A."

Showing the Test of Thirty 20-Light Meters of Maker No. 1.

Meter Tested. No.	Capacity Per Hour Under Loss of Pressure of 3-10 In.	4-10 In.	5-10 In.
1	160.20	†205.20	254.40
2	170.40	222.00	260 40
3	175.20	223.80	259.80
4	168.00	216.00	240.00
5	170.40	224.40	255.60
6	†158.40	226.80	238.20
7	169.20	220.80	†237.60
8	*182.40	218.40	*262.80
9	160.80	*228.00	253.20
10	168.00	221.40	247.20
11	176 40	213.60	261.00
12	169.20	222.60	249.00
13	159.60	208.80	250.80
14	166.80	215.40	240.00
15	174.00	223.80	259.20
16	175.20	214.20	258.00
17	168.00	216.00	249.60
18	166.20	214.80	242.40
19	166.80	217.20	243.60
20	174.00	223.80	260.40
21	169.20	220.80	244.80
22	160.80	208.20	250.80
23	171.00	221.40	259.20
24	171.60	221.40	259.20
25	174.00	223.20	260.40
26	168 00	218.40	249.60
27	165.60	214.20	255.60
28	169.20	223.80	256.80
29	174.60	222.60	258.00
30	162.00	210.00	255.60
Total	5,065.20	6,561.00	1,573.20
Average cap. per hour per meter.	168.84	218.70	252.44
*Maximum " " any " .	182.40	228.00	262.80
†Minimum " " " " .	158.40	205.20	237.60

Average temperature, 79° F.

TABLE "A."

Showing the Test of Thirty 20-Light Meters of Maker No. 3.

Meter Tested. No.	Capacity per Hour Under Loss of Pressure of 3-10 In.	4-10 In.	5-10 In.
1	168.00	†198.00	229.20
2	†152.40	198.00	†228.00
3	182.40	214.80	237.60
4	183.60	213.60	235.20
5	*190.80	218.40	240.00
6	189.00	219.00	242.40
7	180.00	213.60	240.00
8	162.00	217.20	240.00
9	180.00	208.80	247.20
10	172.80	199.20	242.40
11	181.20	207.60	246.00
12	182.40	213.60	235.20
13	190.80	210.60	241.80
14	162.00	214.20	240.00
15	182.40	207.60	*247.20
16	180.60	214.80	237.60
17	188.40	218.40	242.40
18	181.80	214.20	240.60
19	179.40	213.00	235.20
20	190.20	*220.20	242.40
21	183.00	213.60	238.80
22	184.20	214.80	235.20
23	184.80	216.00	237.60
24	189.60	217.20	240.00
25	188.40	210.00	241.20
26	187.80	208.20	246.00
27	190.20	216.60	240.00
28	189.60	214.20	238.80
29	184.20	213.00	235.20
30	187.80	216.60	241.20
Totals	5,449.80	6,375.00	7,184.40
Average cap. per hour per meter.	181.66	212.50	239.48
*Maximum " " any " .	190.80	220.20	247.20
†Minimum " " " " .	152.40	198.00	228.00

Average temperature, 81° F.

TABLE "A."

Showing the Test of Thirty 20-Light Meters of Maker No. 2.

Meter. Tested. No.	Capacity per Hour Under Loss of Pressure of 3-10 In.	4-10 In.	5-10 In.
1	99.00	144.00	171.60
2	118.20	156.00	177.60
3	93.00	129.00	168.00
4	93.60	127.80	165.60
5	119.40	155.40	177.60
6	*120.00	156.00	*178.20
7	96.00	150.00	174.00
8	wnt. reg.	152.40	168.01
9	109.20	136.80	163.20
10	†84.00	130.80	163.20
11	100.80	144.00	172.20
12	96.60	144 00	172.80
13	106.80	136.20	162.00
14	117.60	*157.20	172.80
15	97.80	130.20	168.00
16	96.00	130.80	162.00
17	109.20	136.80	168.00
18	94.20	127.80	†156.00
19	98.40	133.20	168.00
20	117.60	156.00	170.40
21	96.60	130.20	159.60
22	93.00	132.00	163.20
23	109.20	143 40	171.60
24	106.80	144.00	172.80
25	100.80	133.80	168.00
26	109.80	136.80	168 60
27	94.80	128.40	156.00
28	109.80	136.20	166.80
29	93.60	133.20	168.00
30	94.20	†126.60	157.20
Totals	2,976.00	4,179.00	5,031.00
Average cap. per hour per meter.	99.20	139.30	167.70
*Maximum " " any " .	120.00	157.20	178.20
†Minimum " " " " .	84.00	126.60	156.00

Average temperature, 83° F.

TABLE "A."

Showing the Test of Thirty 20-Light Meters of Maker No. 4.

Meter Tested, No.	Capacity per Hour Under Loss of Pressure of 3-10 In.	4-10-in.	5-10-In.
1	160.80	208.80	244.80
2	169.20	211.20	250.80
3	160.80	210 00	244.80
4	159.60	201.60	246.00
5	159.60	204.00	244.80
6	162.00	206.40	243.60
7	159.60	201.60	†223.20
8	159.60	196.20	232.80
9	†153.60	198.00	228.00
10	160.80	196.20	230.40
11	159.00	†195.60	230.40
12	156.00	199.20	229.20
13	154.20	197.40	228.00
14	159.00	196.80	230.40
15	161.40	203.40	240.00
16	160.20	205.80	240.00
17	162.00	207.00	242.40
18	160.80	203.40	247.20
19	159.00	198.00	237.60
20	158.40	196 80	235.20
21	159.60	204.00	244.80
22	158 40	202.80	240.00
23	160.80	204.60	241.20
24	168.60	210.60	249.60
25	161.40	205.20	242.40
26	159.60	207.00	243.60
27	*170.40	*212.40	*252.00
28	162.00	206.40	243.60
29	159.60	205.80	244.20
30	162.00	207.00	246.60
Totals	4,818.00	6,103.20	7,197.60
Average cap. per hour per meter.	160.60	203.44	239.92
*Maximum " " any " .	170.40	212.40	252.00
†Minimum " " " " .	153.60	195.60	228.20

Average temperature, 81° F.

TABLE "A."

Showing the Test of Thirty 20-Light Meters of Maker No. 5.

Meter Tested. No.	Capacity per Hour Under Loss of Pressure of 3-10 In.	4-10 In.	5-'0 In.
1	99 60	139.80	171.60
2	†93.60	131.40	165.00
3	94.80	†129.60	†156.00
4	102.60	139.80	159.60
5	102.00	144.00	168.60
6	109.20	141.60	166.80
7	108.00	139.20	163.20
8	106.20	*153.60	*175.80
9	109.20	138.00	171.00
10	102.00	138.00	166.80
11	99.00	142.80	168.00
12	101.40	139.80	160.80
13	100.80	144.00	168.00
14	102.00	139.80	159.60
15	106.80	142.80	168.00
16	104.40	139.80	162.00
17	105.60	142.80	172.80
18	103.20	139.80	169.80
19	102.00	139.20	160.80
20	109.20	140.40	163.20
21	*109.80	139.20	171.60
22	108.00	138.00	162.00
23	108.00	136.80	165 60
24	105.00	143.40	168.00
25	103.80	139.20	160.80
26	104.40	141.00	162.00
27	106.80	139.20	163.20
28	102.60	138.00	160.80
29	106.20	135.60	161.40
30	102.60	132.60	165.00
Total	3,118.80	4,189.20	4,957.80
Average cap. per hour per meter.	103.96	139.64	165.26
*Maximum " " any " .	109.80	153.60	175.80
†Minimum " " " " .	93.60	129.60	156.00

Average temperature, 79° F.

TABLE "A."

Showing the Test of Thirty 20-Light Meters of Maker No. 7.

Meter Tested. No.	Capacity Per Hour Under Loss of Pressure of 3-10 In.	4-10 In.	5-10 In.
1	150.00	189.60	232.80
2	†121.20	†150.00	†183.60
3	*158.40	190.80	207.60
4	125.40	189.60	222.00
5	150.00	198.00	232.80
6	150.00	186.00	226.20
7	140.40	180.00	210.00
8	146.40	186.00	214.80
9	152.40	177.60	211.20
10	143.40	186.00	216.00
11	154.20	192.60	228.00
12	130.80	190.80	225.00
13	148.20	188.40	225.60
14	130.80	187.20	223 80
15	147.00	186.00	218.40
16	121.80	150.00	201.60
17	151 80	168.00	211.80
18	148.80	181.20	213.60
19	151.20	188.40	204.00
20	151.80	186.00	224.40
21	148.20	187.20	220.80
22	147.00	184.80	219.60
23	149.40	186.60	225.60
24	152,40	197.40	232.80
25	130 80	187.80	220.80
26	144.00	186.00	216.00
27	150.60	*198.60	232.20
28	150.60	192.00	*234.00
29	134.40	188.40	219.60
30	150.60	189.60	229.80
Ttotals	4,332.00	5,550.60	6,584.40
Average cap. per hour per meter.	144.40	185.02	219.48
*Maximum " " any " .	158.40	198.60	234.00
†Minimum " " " " .	121.20	150.00	183.60

Average temperature, 80° F.

TABLE "A."

Showing the Test of Thirty 20-Light Meters of Maker No. 6.

Meter Tested, No.	Capacity per Hour Under Loss of Pressure of 3-10 In.	4-10 In.	5-10 In.
1	187.20	223.20	*261.00
2	177 60	208.80	247.80
3	189.60	217.20	256.20
4	184 80	225.00	255.60
5	162.00	225.60	244.80
6	188.40	216.60	252.00
7	189.00	223.80	259.20
8	185.40	226.80	255.60
9	180.00	212.40	255.60
10	184.80	220 20	248.40
11	186 00	*226.80	254.40
12	†160.80	222.60	242.40
13	188 40	216.60	252.00
14	162 60	226.20	243.60
15	160.80	223.20	†242.40
16	189.00	217.20	252.00
17	*190.20	217.20	256.80
18	176.40	†207.00	247.20
19	178.20	209.40	249.60
20	183.00	225.00	254.40
21	182.40	216.00	248.40
22	178.80	212.40	248.40
23	180.00	214.20	248.40
24	189 60	217.20	252.00
25	163.20	219.60	242.40
26	162.60	221.40	244.80
27	187.80	216.00	250.80
28	162.00	218.40	242.40
29	Won't pass gas.		
30	189.00	217.20	252.00
Totals	5,199,60	6,343.20	7,260.60
Average cap. per hour per meter.	173.32	211.44	242.02
*Maximum " " any " .	190.20	226.80	261.00
†Minimum " " " " .	160.80	207.00	242.40

Average temperature, 78° F.

TABLE "A."

Showing the Test of Thirty 30-Light Meters of Maker No. 1.

Meter Tested. No.	Capacity Per Hour Under Loss of Pressure of 3-10 In.	4-10 In.	5-10 In.
1	170 40	228.00	266 40
2	164.40	221.40	260.40
3	†156.00	†202.80	260.40
4	168.00	222.00	†254.40
5	193.80	235.20	271.20
6	184.80	222.60	261.60
7	181.80	224.40	264.00
8	184.80	225.60	265.20
9	182.40	230.40	266.40
10	*193.80	*235.80	*273.60
11	183.00	225.00	264.60
12	171.00	227.40	266.40
13	181.20	223.80	264.00
14	184.80	227.40	261.60
15	183.60	224.40	265.20
16	168.00	223.20	254.40
17	183.60	229.20	261.60
18	167.40	222.00	254.40
19	162.60	219.00	259.20
20	166.20	223.20	255.00
21	165.60	220.80	260.40
22	162.00	216.00	259.20
23	182.40	227 40	262.80
24	181.80	225.00	263.40
25	193 20	233.40	270.00
26	184.80	224.40	264.60
27	182.40	227.40	262.80
28	183.00	228.60	264.00
29	183.00	225.00	264.60
30	181.80	228.00	264.00
Totals	5,331.60	6,748.80	7,885.80
Average cap. per hour per meter.	177.72	224.96	262.86
*Maximum " " any .	193.80	235.80	273.60
†Minimum " " " .	156.00	202.80	254.40

Average temperature, 80° F.

TABLE "A."

Showing the Test of Thirty 30-Light Meters of Maker No. 2.

Meter Tested, No.	Capacity Per Hour Under Loss of Pressure of 3-10 In.	4-10 In.	5-10 In.
1	†163 20	230.40	†264.00
2	172.80	225.60	278 40
3	196.80	252.00	280.80
4	182.40	228.00	*297.60
5	199.20	*255.60	288.00
6	173.40	224.40	265 80
7	174.00	225.60	264.00
8	170.40	224.40	273.00
9	173.40	225.00	274.80
10	*220.20	255.00	288.60
11	171 60	223.80	271.20
12	172.80	225.00	279.60
13	172.20	223.80	272.40
14	174.00	224.40	265.80
15	173.40	223.80	266.40
16	172.20	226.20	276.00
17	171.00	225.00	273 60
18	171.60	228.60	268.80
19	188.40	246.00	286.20
20	174.00	226.20	274.80
21	163.80	228.00	264.60
22	171.60	226.20	278.40
23	194.40	253 20	288.00
24	180.00	226.20	274.20
25	174.00	225.60	274.80
26	173.40	226.20	277.20
27	176.40	230.40	279.60
28	174.00	224.40	265.20
29	183.60	246.60	283.20
30	172.80	†223.20	276.00
Totals	5,331.00	6,928.80	8,265.00
Average cap. per hour per meter.	177.70	230.96	275.50
*Maximum " " any .	220 20	255.60	297.60
†Minimum " " " .	163 20	223.20	264.00

Average temperature, 78° F.

To be Concluded.

The Elyria Gas Engine.

A distinguishing feature of the gas engine built by the Elyria Gas Engine Company, Elyria, O., in sizes of from 10-horse power up, is that either gas or gasoline may be used as fuel, and the change from one to the other may be made without stopping the engine. Another peculiar feature is that it is so designed and arranged as to require no readjusting when worn by service. It is a 4-cycle engine of comparatively simple construction and few parts. The manufacturer states that in designing this engine the principles of steam engine construction were applied wherever they could be of advantage in the construction of a gas engine. The principal claims made for the engine are that it maintains close speed regulation and that it requires only a reasonable amount of attention and care. Symmetry of design is another feature of individuality in this engine. In its manufacture all parts are made from templets, jigs and gauges, insuring interchangeability.

While the engine does not occupy a larger floor space than is customarily allowed to other engines of equivalent power the frame has a much longer foundation bearing than usual. In the disposition of material in the frame the aim was to place the greater part of the weight where it would best withstand the strain caused by the force of the explosions. The crank shaft bearings are contained in the one frame casting, so that they cannot get out of alignment. This construction also permits placing the flywheels close to the bearings, with no gears interposed. The right hand flywheel—that is, the near one in the illustration, Fig. 1 is always the one from which the belt is taken. This causes the belt pull to be borne by the outer bearing, while the bearings on each side of the crank receive the force of the explosions. The crankshaft bearings are set at an angle of 45° to diminish the strain on the caps. The frame is bored and faced to fit an end face and cylindrical projection on the cylinder casting. Studs are screwed into the cylinder casting and project through the housing to receive nuts on the inside of the latter. This means of fastening the cylinder to the frame permits free expansion in all directions.

The chamber containing the valves is a separate casting from the cylinder. It is fastened to the cylinder by 4 studs and is thoroughly water jacketed. To keep the valves and cylinder at even temperature a portion of the cooling water is passed through the valve chamber jacket to the cylinder jacket. The inlet and exhaust valves open into

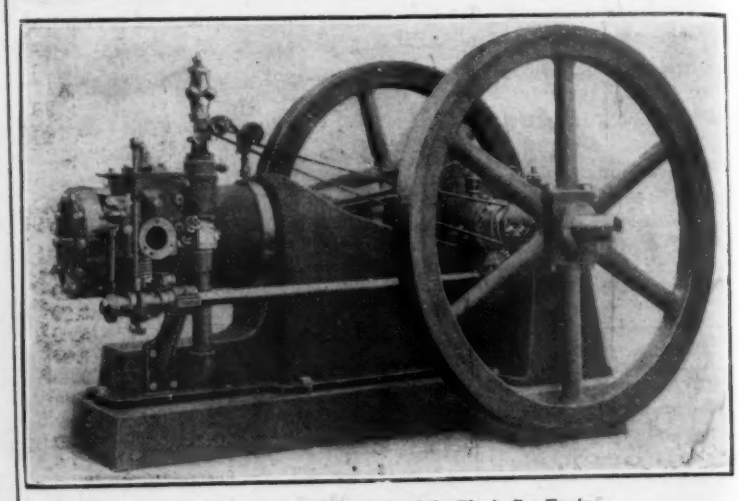

Fig. 1.—View of Belting Side of the Elyria Gas Engine.

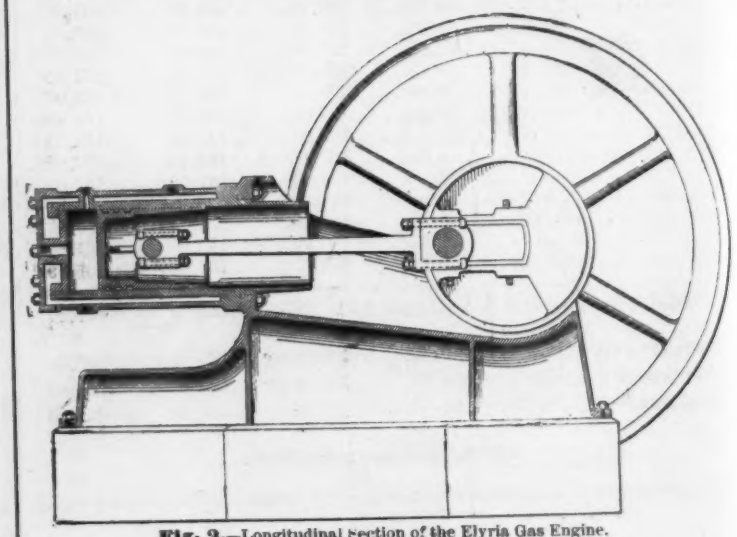

Fig. 2.—Longitudinal Section of the Elyria Gas Engine.

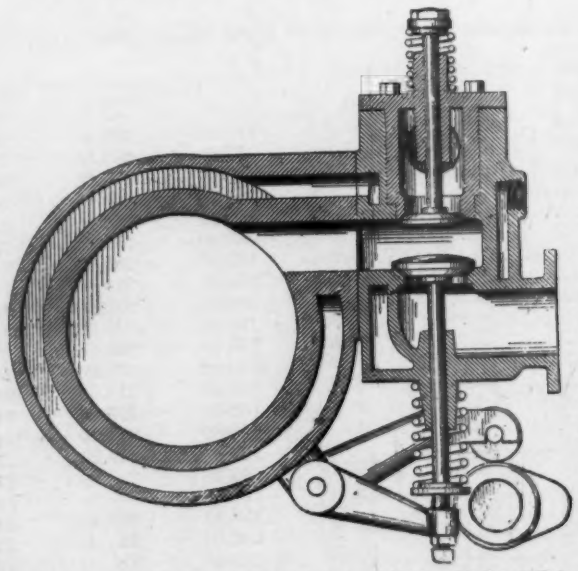

Fig. 3.—Cross Section Through the Cylinder and Inlet and Exhaust Valves.

the same chamber and are placed one above the other, the exhaust valve being beneath. The exhaust valve seat is in one piece with the chamber castings. The inlet valve is seated on a separate casting, which is inserted in the top of the main chamber, the joint between the two being ground and and held tight by 4 screws. By removing these screws the inlet valve and seat may be withdrawn. By removing the pin from the stem of the exhaust valve the latter may also be withdrawn through the opening for the inlet valve casting. Both valves are of poppet type, and work up and down vertically, so that there is no excessive wear on the sides of the valve stems. The valves are opened positively by cams instead of depending upon suction, and are closed by springs.

The engine speed is regulated by throttling the amount of mixture of

air and gas admitted. This system has the advantage of preventing a greater amount of gas and air being drawn into the cylinder at each stroke than is required to maintain a normal speed, and the explosions are regular in time, which is not the case with the "hit-and-miss" system of governing. At no load the governor almost closes the throttle and the explosions are very light. When the speed diminishes with the throwing on of the load the governor increases the amount of the mixture admitted, thus increasing the force of the explosions. The proper proportion of gas to air in the mixture may be regulated while the engine is running by varying the volume of gas admitted. The suitable ratio once obtained remains constant, as the governor automatically regulates both gas and air. The governor valve may be taken out for cleaning by removing the screws.

The piston is of the trunk pattern, and has a large bearing surface. It may be withdrawn through the crank end of the cylinder without disturbing the cylinder head. The pin which serves as a bearing for the end of the connecting rod is of steel, case hardened and ground to size, and is held in position by two set screws.

The crank shaft is a one-piece steel forging drawn from the billet and machined to gauge. Counterbalancing disks, bored to fit the shaft and having pockets to receive the crank arms, are secured to it by large set screws. This method of placing the counterbalances brings them directly in line with the weight to be balanced, and does away with bending strain on the shaft.

Ignition is by means of an electric spark, the plug for which is placed in the valve chamber between the inlet and exhaust valve, where it has the benefit of the cooling effect of the incoming air, thereby prolonging the life of the sparking points. Provision is made for changing the time of ignition while the engine is running. This is important, since in starting it is desirable to ignite later in the stroke than when full speed is attained, and the time of ignition very materially affects both the power and economy of the engine, especially when different kinds of fuel are used.

The cylinder head is thoroughly water jacketed and is arranged so that the force of the explosions do not come directly against the packing interposed between the cylinder and the head, which makes it much easier to keep the head joint tight. All engines of 15-horse power and over are provided with automatic starting apparatus consisting of an air compressor and storage tank. The air pipe connection from the tanks is made through an opening provided in the center of the cylinder head. The cylinder wall is extra heavy at the points where the strain is most severe. The water jacket which surrounds the cylinder is arranged so that it may be cleaned without removing the head. All the working parts are on the outside of the cylinder and are few in number.

All the principal rubbing parts are lubricated automatically, and there is no waste of the oil supply to the journals. Sight feed cups supply the cylinders, and but little attention is required by the lubricating devices. Before the engines are shipped they are tested, not only for fuel consumption and ability to carry the rated load, but to insure that they do not lose perceptibly in efficiency with a 20 per cent. overload.

Lightning Rods, Wireless Telegraphy and the Dispersion of Fogs by Electricity.

By Mr. A. F. Collins, in *Elec. World.*

The aerial wire which has played so important a part in serving as a guard against lightning and as a radiator and antenna in wireless telegraphy is destined to assume another and quite as clever a role in the new art of the dispersion of fogs by electricity.

While the record of past events concerning the extension of a wire perpendicular to the surface of the earth, having its base grounded, its opposite end elevated several meters above and terminating in free air, are for the first two purposes just cited well known, yet a short review of these processes will form admirable comparisons with the one to be described.

The theoretical considerations involved in the action of the lightning rod make it an easy matter to understand its relation to the phenomena of dissipating the electrically charged atmosphere, at least in its immediate neighborhood, and this with the practical evidence based on its use for the past 150 years, has rendered it a thing of exceeding simplicity and one no longer necessary to conjure with.

Not so with aerials employed in wireless telegraphy, for certain factors yet remain unknown, as, for instance, the earth; as a consequence the laws relating to the function of the grounded wire are not so well comprehended, although the fundamental facts of electric wave propagation upon which the art is founded are clearly enough elucidated, but the subject in its entirely is much more complicated, while its period of development has been limited to the last few years.

Wireless telegraph operators are often confronted during the passage of a thunderstorm with innumerable sparks of greater or lesser intensity, jumping from one wire to another wherever the proximity is such that a short gap may be presented, assuming the aerial switch is left closed. This result is not caused by lightning actually striking the aerial, but is merely due to the accumulation of a charge of atmospheric electricity on the wire, and since this is always of the opposite sign to that of the earth immediately beneath on the grounded terminal, the two charges manifesting a difference of potential equal sometimes to a pressure of a 100,000 volts or more.

While all this may be interesting it is not new, for Franklin deduced this conclusion in 1749, and demonstrated it by actual experiment in 1752, when by resorting to a very simple, original but withal ingenious expedient, which consisted of elevating a conductor by means of a kite he was enabled to identify lightning with electricity.

Franklin's kite and the ones used in field operations when sending and receiving wireless messages were constructed on somewhat different lines, yet both have points in common, in that they fly and that they serve admirably the purpose for which they were intended. Franklin's kite was made of a couple of cross sticks covered with a silk handkerchief instead of paper, so that it would easily withstand the action of the rain upon it. To the vertical stick was fastened a metal point for the accumulator of electricity. The learned doctor applied to this a hempen string and to the lower end he tied a brass key; finally from the key a cord of silk was led and secured to a stake driven in the earth.

These little arrangements may be taken to indicate the philosophic turn of the doctor's mind. The tailless kite had not yet been invented, but the silken kite with its long tail did not detract in the least from the successful issue of the test. Aluminum had not been discovered and any other kind of a wire would have been too heavy; the alternative was a hempen cord, which when wet would, as Franklin knew, conduct the high tension energy without appreciable resistance.

The key would serve as a small capacity area, while the silk cord was brought into the scheme to prevent leakage from the key to the earth. With this arrangement America's first electrician was enabled, repeatedly to draw sparks from the key with his knuckle, to charge a Léyden jar and prove by many other essays that lightning, produced by the electrically charged atmosphere, was exactly the same as that induced by a frictional machine. This being so, it was evident to the rare mind of Franklin that a heavy wire projecting above the highest peak of a house or mounted on the top of a church spire would serve to dissipate the charge by providing the positive and negative electricities with a path of little resistance for the equalization of their potential differences and thus prevent disruptive discharges between the upper atmosphere and the earth via the intervening building.

The lightning rod, or lightning guard, as the English term it, was the result of this generalization and has furnished protection for millions of houses from the terrific results of atmospheric disruptive discharges; wherever civilization attains there one may also observe the lightning rod with its metal terminals reaching for the charge which it is to render harmless.

The functions of wireless telegraph aerials are different from those of the lightning rod and again the specific operation of the sending and receiving wires of an electric wave system are diametrically opposed though the arrangement is such that the wires themselves remain uncharged; as an illustration of the points in question, imagine the radiating wire of a sending apparatus; in its earliest form it was divided at a point near the earth and the spark gap of a high tension machine or coil was here inserted.

Now, instead of desiring the discharge of the upper and lower portions of the conductor, as in the case of the lightning rod, and so neutralizing the energy of the two capacities represented by a portion of the air surrounding the free end of the wire and the earth in the immediate neighborhood of the grounded terminal, the needful thing was to charge these two capacities to a potential where they would break down an air gap, the surging energy taking the form of a spark and giving to the discharge an oscillatory movement which in turn sets up a disturbance in the ether as electric waves.

In receiving the emitted electric waves by the same or a similar aerial wire, now termed for convenience the antenna, the energy pent up in a spherical ether wave when it impinges upon the former would be neutralized instantaneously and without indication if the aerial were in the form of a continuous conductor like a lightning rod and its action would be the same to all intents as in the equalization of atmospheric electricity.

The difference between the antenna and the lightning rod is the insertion of a wave detector in the former causing the received energy to assume an oscillatory character through the system. While Hertz ascertained these facts with experimental radiators and resonators, it must be assumed that Popoff grasped the importance of these prevail ing conditions in the application of his wireless meteorological indicator and likewise that Marconi was cognizant of them when he found that an earthed terminal and increased elevation of his sending aerial assisted largely in increasing the effective range of his instruments.

The investigations of Slaby in respect to the earthed terminals of the sending and receiving wires are interesting in this connection, for he ascertained that either the radiator or the antenna could be a continuous conductor if it were provided at the point at which it entered the earth, if he joined another wire of equal length, leading it to the spark-gap or coherer; if the length of the straight vertical aerial conductor was one-fourth the wave length emitted by the closed circuit thus formed and the subsidiary wire was of equal length to the vertical aerial, then a nodal point of the system would be formed at the juncture of these wires with the earth.

Lodge's results are now in order. He with the assistance of the British physicist, Clark, repeated a series of simple but remarkable experiments made by Lyndall as early as 1870 relating to the phenomena of dust-laden air and its dispersion by means of a red-hot body. Lyndell evolved a hypothesis to account for this action based on the assumption that the air was projected in convection currents at a higher velocity than the dust held in suspension in it which was naturally retarded.

This hypothesis did not entirely fulfil all the requirements for dust of all kinds, whether of organic or inorganic origin, is similarly affected. In 1880 Lord Rayleigh made some observations that had a bearing on the subject in question, showing that ice held under the dusty air had an effect similar to a red hot poker held over it, and that the dust free space was as prominent in the one as in the other experiment.

Another observation made by Rayleigh, but one which seemed to have little connection at the time with those just mentioned, was the effect of an electrified body on water jets; it was clearly evident that an electrified stick of sealing wax held near the jet at the point where it broke into drops sufficed to cause the more minute particles in the form of mist, to cohere and fall in very large globules of water.

Three years later Lodge and Clark began the work of sifting these experiments in an effort to account for the dispersion of dust in a logical manner, with the result that they finally concluded that the dust free space, whatever the nature of the particles, was caused by an electrical bombardment of the minutely segregated substances.

In these essays the red hot poker and portion of ice were discarded and instead a metallic electrode charged to a few hundred volts was used; when plunged into dusty air it had an identical though not nearly so prominent effect as the former, yet the action of high and low temperatures and electric charges were similar. These operations were conducted in free air and the next step was to inclose the dust laden air in a box or bell jar; terminals were provided so that they extended into the interior of the vessel and these were connected to the poles of a high tension apparatus such as a static electric machine.

It was now possible to obtain a potential difference of many thousand volts and when the terminals were separated just beyond the striking distance a brush discharge occurred which produced an action that was indeed surprising, for the dust held in suspension was instantly precipitated, leaving the air clear and pure.

Not only was dust dispelled in this manner, but all kinds of smoke and fumes succumbed to the process just as easily. It was likewise ascertained that the positive charge was the most effectual in its action and in some of the experiments the negative terminal was placed in a position appositely disposed to the positive and in others the negative pole was connected to the earth.

By thus changing the terminals and their relative positions and by employing vapors and dusts of different substances, varying phenomena were obtained; by way of illustration, when dust of magnesium was subjected to the electrification process minute portions became charged to the opposite signs and in consequence were attracted to each other with considerable energy, forming little spheres and these acquiring like charges were repelled, causing them to strike the sides of the bell jar.

Cause and effect such as the above led the physicist to take up the matter of fog and fume expellation, which he recently carried out at the University of Birmingham, England. The arrangements for these trials were on a much larger scale than any before attempted, yet withal exceedingly simple, resembling quite closely the sending equipment of a wireless telegraph station. It consisted of a wire suspended in the air from a staff on the roof of the University, the upper end terminating in a number of points radiating in every direction; the base of this wire, which was carefully insulated, was attached to the prime or positive knob of a large static machine; the negative knob was connected with the earth by means of an insulated wire.

When the machine was set into motion a potential difference of perhaps a million volts was established and could be maintained between the free end of the aerial and the earthed terminal of the system. On making a practical test of the theory of defogging the atmosphere by means of the above apparatus it was found that the fog was easily dispersed and the air cleared for a distance of 150 to 250 feet around the elevated points for as long a period as the machine was in operation. When the machine was stopped the fog, of course, quickly filled in the cleared space.

Several years ago Lodge designed an apparatus for use in large industrial works where dust and fumes predominated. In nearly all factories there is to be found suspended in the air either fine dust or fumes which are highly poisonous; again, some of these contain products of exceeding value when they are precipitated. In flour mills and coal mines the dust is dangerously explosive, and in copper and arsenic works it is at once both poisonous and valuable. In some of the lead smelting works the lives of the workers are endangered by the fumes which escape with the smoke from the smelting furnaces, and Lodge has applied to these the electrical process of condensation on a comparatively large scale.

These various and numerous trials having proved successful, Lodge sought to extend the results to out-of-door practice. His idea crystallized in a scheme for dispelling fog on the Mersey River. This would, of course, necessitate much more efficient methods for generating high potential differences than the static or other influence machines. It is well known that in wireless telegraph emitters high potentials alone do not suffice in sending out effective radiations, but that current is also essential. For this reason induction coils have their secondaries wound with much shorter and thicker wire than in the ordinary types heretofore made, so that while the voltage at the terminals is reduced somewhat the input in amperes is increased.

Similar conditions are required in the dispersion of fogs on a commercial basis. But the difference between an emitter used in wireless telegraphy and a disperser for fog precipitation is that in the former a disruptive discharge is employed for setting up in the radiator system currents that are oscillatory in character, while in the latter there is no spark gap and therefore the complementary sides of the system, *i.e.*, the aerial and grounded terminal, do not change in polarity, but serve to ionize the foggy air by projecting streams of electricity into it of a given sign.

The designer suggests that for this purpose a Cooper Hewitt electrifier be connected with the secondary terminals of a transformer one side of which leads to the aerial and the opposite side to earth, the transformer receiving its initial energy from an alternating current generator of suitable size; in this manner a current of any desired amperage and any voltage may be obtained.

Lodge has pointed out that the same process of electrification may be extended in the art of rain making; in exceedingly dry countries aerial wires of aluminum may be attached to a balloon or kite and elevated to a point where it will come in contact with the watery particles of a passing cloud, when the discharge of electricity into it will cause the floating particles of vapor to coalesce and fall in the form of rain.

The vertical wire in the air, grounded at its base, has served mankind well since Franklin first indicated a use for and it is now doing great work in wireless telegraphy, but it may be destined to fulfill even a greater mission in the dispersion of fogs and the production of rain. Dispelling fogs on rivers and around ships may be near at hand, since it has been accomplished; the procedure for making rain has been pointed out, but is as yet a little in the future; after the realization of this a perpetual supply of "pure electricity," "milked from the ether," by means of a high aerial wire, will be in order.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE California Gas and Electric Company has purchased the rights and properties of the Vallejo (Cal.) Gas and Electric Company.

MR. W. A. MCCLURG, since 1890 in charge of the electric division of the properties of the Plainfield (N. J.) Gas and Electric Company, has resigned from the Company's service.

THE price bid at sheriff's sale for the belongings of the Utica (N.Y.) Gas Engine Works, was $1,150.41. The nominal purchaser was John C. Bulmer.

A CORRESPONDENT in Albuquerque, New Mexico, writing under date of the 22d ult., informs us that "a pair," known as J. A. Jones and F. H. Kent, have applied to the authorities for the right to construct and operate a gas works in the named place. They agree to furnish gas at $1 per 1,000 cubic feet. The chance for profit in an enterprise of the sort named at the proposed price in Albuquerque can be readily understood when it is noted that coking coal costs there $5 the short ton, and that "enriching oil" is worth 10 cents per gallon.

MESSRS. GRAHAM, MORTON & CO., Limited, of Leeds, England, writing to us under date of November 14th, inclose us a notice of two coal handling plants recently erected by them in two English situations. Describing the construction it is noted that the retort house of the new gas works at St. Helier's, Jersey, and the entire plans for operating the same, were built to the designs of Mr. J. Morris, Engineer to the Gas Company. The installation presents several novel and interesting features, an especially peculiar one being the design of the crusher, which is made in two pieces and so arranged that very large lumps of coal can be crushed without loss of capacity. The contract included the supply and erection of the following: A coal receiving hopper, a jigging screen, two 2-rate crushers, a 24-inch elevator with 50-foot centers, 24-inch standard push-plate conveyor, 142-foot centers, and all the necessary structural work for carrying the plant. Also the supply of one 40-horse power steam engine and the requisite gearing for driving the installation. The second contract is a new coal handling plant for the Australian Gas Light Company (Mortlake works) Sydney, New South Wales, built to the designs of Mr. Thomas J. Bush, Chief Engineer. The Resident Engineer is Mr. Bertram Stanway, whom many American gas engineers will remember as the assistant to Mr. Herring during the latter's construction of the Granton gas works, at Edinburgh. The Australian contract included the supply and delivery of 2 receiving hoppers; 2 standard 4-roll crushers; two 12-inch lattice braced elevators; two 16-inch rubber belt conveyors; 2 coal bumpers, with the necessary structures for supporting the same; and two 17½-brake horse power steam engines, with the requisite shafting and gearing for driving the entire plant.

AT the annual meeting of the Suffern (N. Y.) Gas Company, the officers chosen were: Directors, P. V. Hewitt, Edgar Tilton, S. H. M. Agens, M. T. Welsh, A. P. Condit and S. F. Hayward; President, Edward Oakes; Treasurer, S. N. Pennington; Secretary, D. W. La Fetra.

THE daily prints inform us that the El Paso (Tex.) Gas and Electric Company, with a capitalization of $500,000, and the purpose of supplying gas and electric light in El Paso and in Juarez, Mexico, has been incorporated by the following: Barrett Ridgely, George F. Goodnow, Fletcher S. Heath, F. R. Crane, Edward Clifford, George D. Flory and Charles Bassett.

THE York (Pa.) Gas Company has been going over its main system, which seems to have received not more than a fair share of attention in recent years.

MR. F. K. LANE has been appointed General Manager of the Fishkill and Matteawan Gas Company, of Fishkill, N. Y.

THERE seems to be some sort of trouble in the main system of the Danbury and Bethel Gas Company, of Danbury, Conn.; so the residents of Elmwood Park say. If we mistake not, the service "out Elmwood way" is of the high pressure sort.

THE proprietors of the Fall River Gas Works Company, Fall River, Mass., have arranged for an increase in the capital stock.

THE McLewes Gas Lamp Company, of Trenton, N. J., has been incorporated. It is capitalized in $100,000, and the chief ones in interest are said to be Messrs. Joseph F. Cotter, F. R. Hansel and G. H. B. Martin.

MR. F. SPENCER is no longer connected in any way with the properties of the Monmouth (Ills.) Gas Company.

THE new gas plant of the Fort Dodge (Ia.) Light and Power Company is now in successful operation.

WE regret to have to report the death of Mr. George H. Hoyt, who died, while on his way to service at St. John's Church, Stamford, Conn., the morning of November 21st. The correspondent who informed us of Mr. Hoyt's death, inclosed the following facts respecting his life: "Mr. Hoyt had been associated with so many interests in Stamford that his death will be severely felt by hundreds outside the family circle so sadly bereaved. Born 65 years ago, he traced his descent from a line of men who, from Stamford's early history had been honorably identified with the substantial interests of the city. His father, James H. Hoyt, to whose place in the business affairs of the community he succeeded, was an important factor in the progress of Stamford in the generation that began with the building of the New York and New Haven Railroad, and the radical changes wrought by that enterprise in local conditions. Beginning life as a cabinetmaker's apprentice, James H. Hoyt soon bought out his master's interest in that business, and then went into the lumber trade upon an extensive scale. With his brothers, William and Roswell, he engaged in mercantile pursuits, dealing extensively in dry-goods and groceries, and importing wares from the West Indies, cargoes being landed at the head of the old canal, which then ran to a point near Atlantic Square. He brought to Stamford the first cargo of hard coal that ever reached the town. When the railroad was built, he became a contractor for grading and bridge building, and furnishing ties for the Company. His experience in construction work proved valuable a few years later, for in 1854 he became General Superintendent of the road, a position he filled till his death in 1873, bringing into play business sagacity and energy then greatly needed, and laying the foundation of the splendid organization which has since contributed to the success of the property. He was also identified with the banking interests of the town, and it was chiefly through his efforts that the Stamford Water Company established its plant—a work which, because of opposition of various sorts, called for all the wisdom, foresight and energy he possessed. The man who died so suddenly yesterday inherited to a large degree the great business capacity of his father. Educated in Stamford schools, he was, when a young man, appointed Agent for the New York and New Haven road in Stamford. After his father's death, he found himself occupied with the many interests with which James H. Hoyt had been associated, and it fell to the lot of the son to build upon the strong foundations the father had laid. In 1878 he became President of the Stamford Savings Bank, of which James H. Hoyt was one of the organizers, and he held that position at the time of his death. He was Vice-President of the Stamford National Bank, another institution with which his father had been associated. He was for many years Treasurer of the Stamford Water Company, and was made Treasurer of the Stamford Gas and Electric Company when that corporation succeeded the old Stamford Gas Light Company. These positions, each important, were by no means all to which Mr. Hoyt gave his time. The universal confidence in his business judgment, the appreciation of his fidelity, resulted in the placing upon him of a multitude of responsibilities as director, guardian and trustee. No man, unless one well equipped with business tact, with the ability to solve problems and to bring into play patience and industry in the mastery of detail, could accomplish a fraction of the work undertaken by Mr. Hoyt. It must have been a pure love for work that stimulated him, and the satisfaction which comes from work well done was sufficient recompense."

MR. J. A. MAYERS, writing under date of the 30th November, says that the proprietors of the Morristown (N. J.) Gas Light Company have awarded a contract to the Gas Machinery Company, of Cleveland, O., for improvements and betterments. The main features in the new work will comprise exhausting and scrubbing apparatus and an ammonia concentrator. The Gas Machinery Company will also put in an ammonia concentrator on the Ann Arbor (Mich.) plant.

THE authorities of Durham, N. C.. are considering the advisability of using Welsbach street lamps for public lighting purposes.

MR. S. W. SMITH, JR., of Cincinnati, has been appointed President of the Warren (O.) Gas Light Company, vice Mr. W. R. Stiles, deceased.

THE proprietors of the Pawtucket (R. I.) Gas Company are conferring with the authorities over a renewal of the gas franchise. The Company is willing, and has so declared, to favor the authorities with a liberal concession in rates, if proper security from competition is granted.

THE AMERICAN GAS LIGHT JOURNAL

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NOTIFICATION RESPECTING ADVERTISING.

Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:

New York—American News Co., 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, DECEMBER 5, 1904.

The Market for Gas Securities.

The market for city gas shares showed no particular change in quoted values since time of last writing, the quotations at the close today (Friday) for Consolidated coming in at 215½ to 215¾. There was some inquiry for Mutual, which was bid 300, offered at 320. Bonds were also in brisk demand.

Brooklyn Union is nominally 218 to 223, but no sales worth chronicling have been reported. There are more rumors about a probable coming together of the gas and electric interests of Brooklyn, but mere rumor, with its inception at the electric end, seems the main basis of the talk. Messrs. Bertron, Storrs & Griscom have secured control in Baltimore Consolidated, for which 84 is freely bid. Peoples, of Chicago, continues strong, and the same may be well said of Washington, D. C., which is 321½ to 322½. Laclede preferred is 95 bid. Hudson County (N. J.) Gas is well beyond the par mark, the figures being 104½ to 105½.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

DECEMBER 5.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	215½	215¾
Central Union, Bonds, 5's.	3,000,000	1,000	108½	110
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	118	120
Mutual	3,500,000	100	300	320
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co. .. Bonds, 5's	11,000,000	1,000	112	113¼
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	35	.
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	..	.	.
Northern Union, Bonds, 5's.	1,250,000	1,000	104	106
New York and East River.. Bonds 1st 5's	3,500,000	1,000	112	114
" 1st Con. 5's	1,500,000	..	106¼	108½
Standard	5,000,000	100	125	130
Preferred	5,000,000	100	145	155
Bonds, 1st Mortgage, 5's	1,500,000	1,000	116	117
Yonkers	299,550	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	218	223
" " Bonds (5's)	15,000,000	1,000	113	115
Bay State	20,000,000	50	—	—
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	28	30
" 1st Mtg. 5's	500,000	1,000	93	96
Boston United Gas Co.— 1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	5	5¾
" " Bonds, 5's	5,250,000	1,000	66	68½
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,656,000	1,000	104	104¼
Cincinnati Gas and Electric Co	29,500,000	100	10	108½
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	97½	99
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	88¼	89½
Preferred	3,036,500	100	107½	109
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	84	..
Mortgage, 6's	2,500,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N. J.	1,000,000	100	15	17
" Con. Mtg. 5's	880,000	1,000	89½	92
Bonds	75,000	..	..	100
Detroit City Gas Co	4,825,500	50	..	50
" Prior Lien 5's	5,803,000	1,000	99½	100
Detroit Gas Co., 5's	381,000	1,000	75	75¼
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	..	104½	105½
" Bonds, 5's	10,500,000	..	107	108
Indianapolis	2,000,000	..	70	75
" Bonds, 6's	2,650,000	..	106½	108
Jackson Gas Co	250,000	50	82	..
" 1st Mtg. 5's	290,000	1,000	101	102¼
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	..	..
Preferred	2,500,000	100	95	..
Bonds	10,000,000	1,000	108½	109
Lafayette Gas Co., Ind.	1,000,000	100	..	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	138	140
Madison Gas & Elec. Co. " 1st Mtg. 6's	350,000	1,000	107½	108¼
" 6 per cent. scrip, due 1910	100,000	25	85	87
Montreal, Canada	2,000,000	100	218	218¾
Nashville Gas Lt. Co.	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	5,000,000	..	56	58
Bonds, 6's	4,600,000	..	105	105¾
New Haven	2,000,000	25	200	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	111½	112
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	
Rochester Gas & Elec. Co..	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	15,800,000	100	58½	58¾
St. Joseph Gas Co. " 1st Mtg. 5's	751,000	1,000	94	96
St. Paul Gas Light Co.	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	113½	115
General Mortgage, 5's	2,465,000	1,000	92	93
Syracuse, N. Y.	1,975,000	100	50	55
Bonds	2,047 000	1,000	102	.
Washington, D. C	2,600,000	20	321½	322½
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	..	..	..
Wilmington, Del.	600,000	50	230	..

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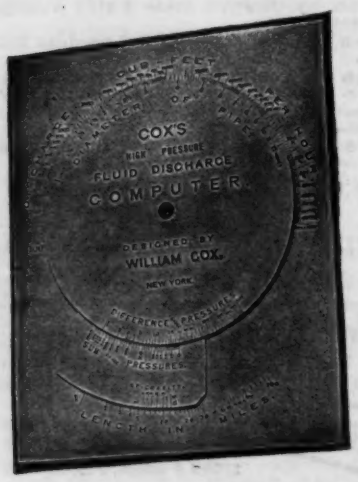

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Where d = diameter of pipe in inches,
p_1 = absolute initial pressure in pounds per square inch,
p_2 = absolute terminal pressure in pounds per square inch,
L = length of pipe in miles,
w = specific gravity of the fluid when air = 1.

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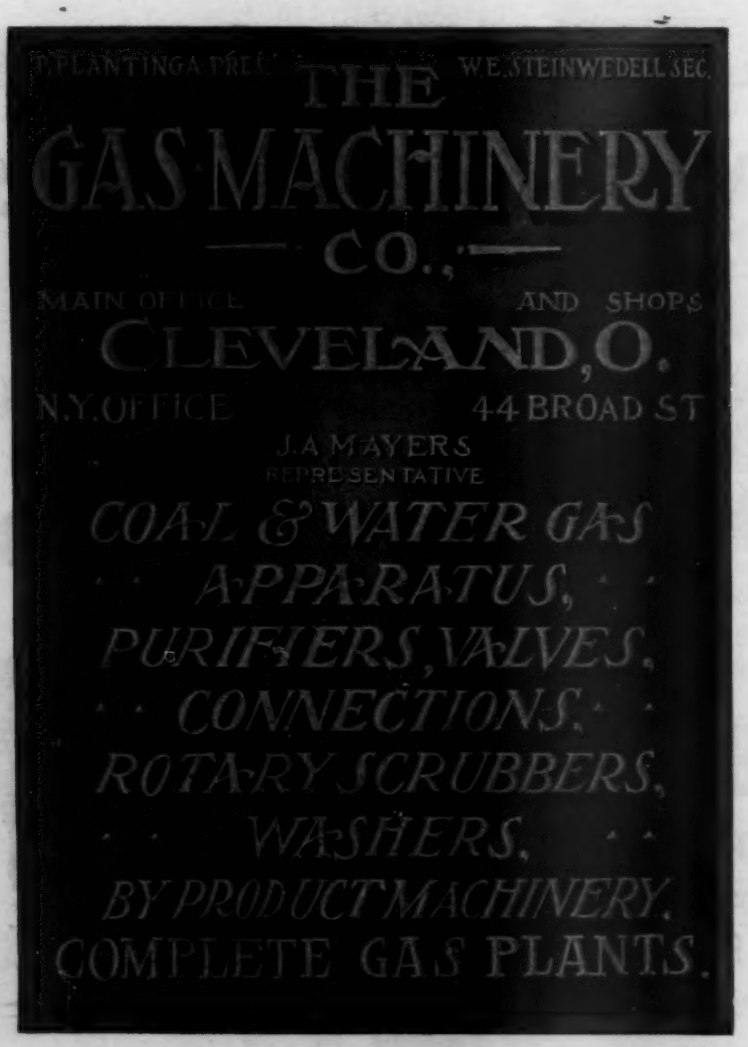

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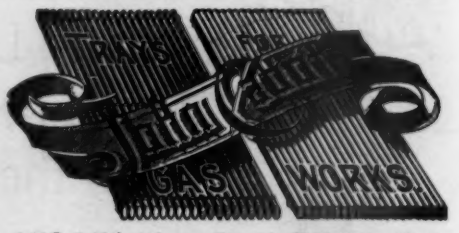

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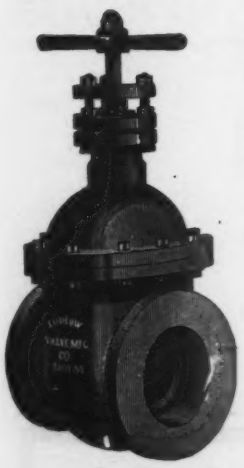

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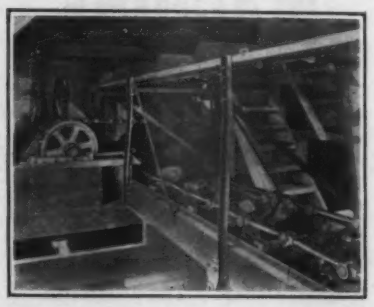

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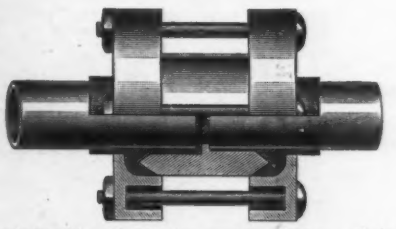

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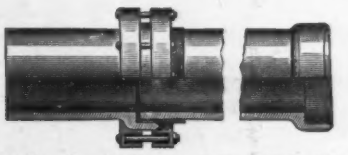

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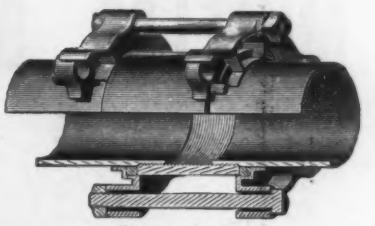

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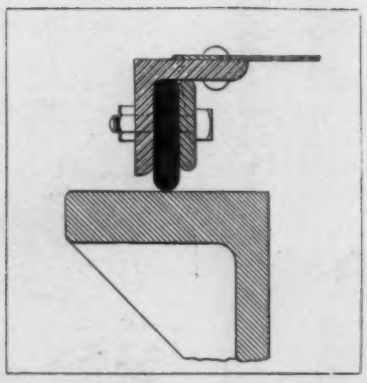

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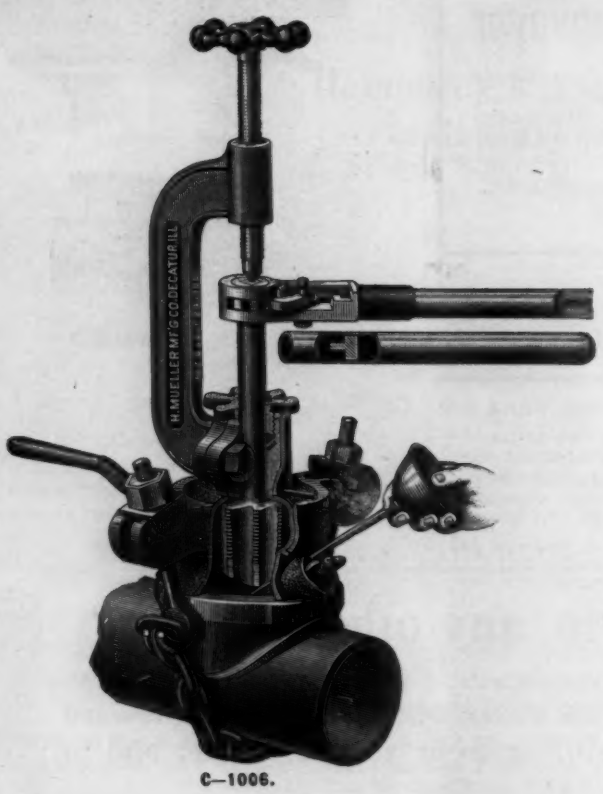

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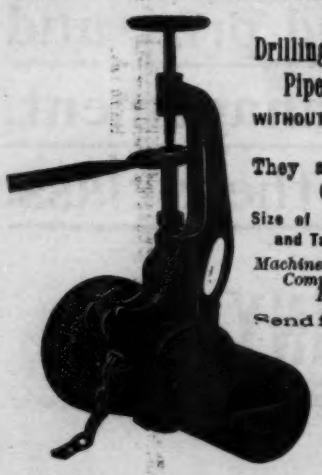

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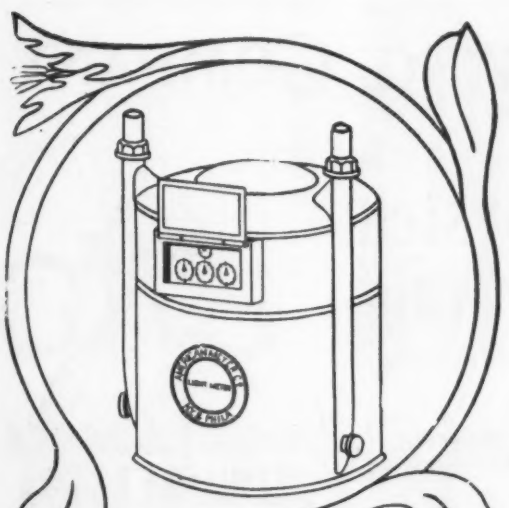
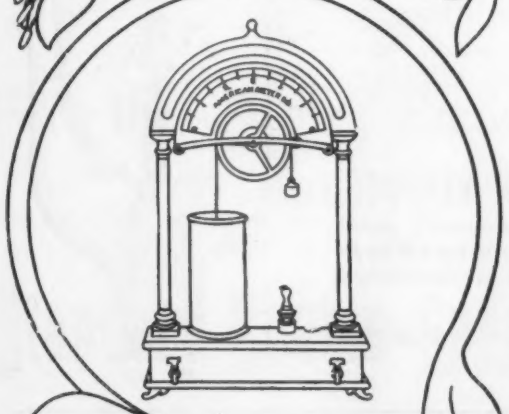
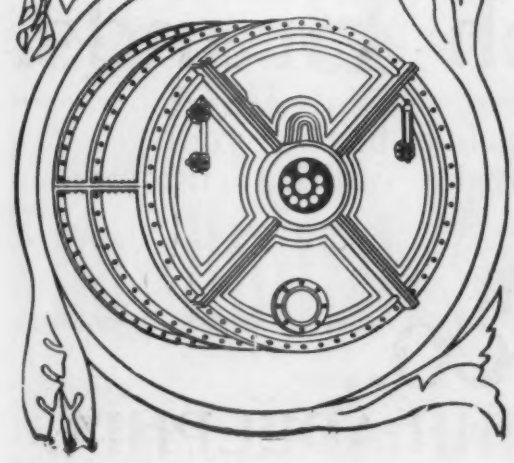
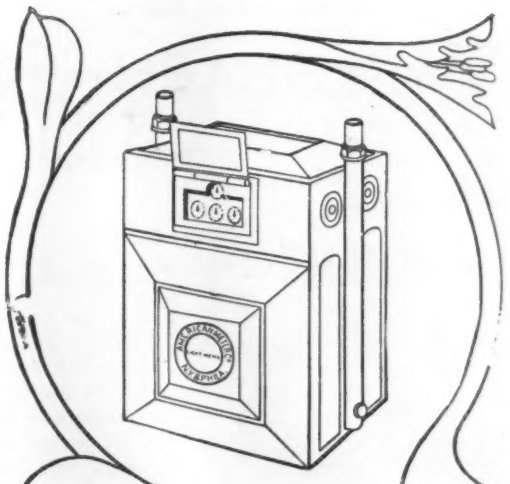
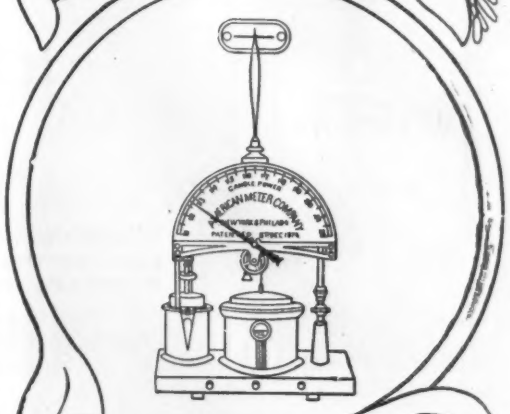
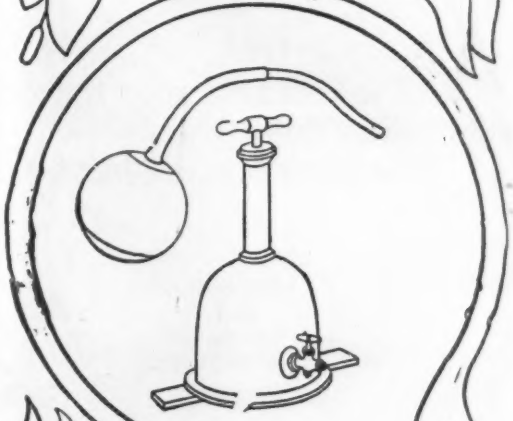


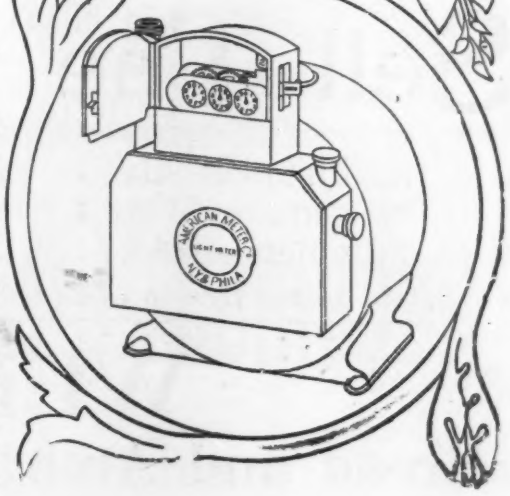












PUBLIC LIGHTING TABLE.

DECEMBER, 1904.

Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Thu.	1	5.10 PM	2.40 AM	4.20	6.10
Fri.	2	5.10	3.50	4.20	6.10
Sat.	3	5.10	6.00	4.20	6.15
Sun.	4	5.00	6.10	4.20	6.15
Mon.	5	5.00	6.10	4.20	6.15
Tue.	6	5.00 NM	6.10	4.20	6.15
Wed.	7	5.00	6.10	4.20	6.15
Thu.	8	5.00	6.10	4.20	6.15
Fri.	9	5.00	6.10	4.20	6.15
Sat.	10	5.00	6.10	4.20	6.20
Sun.	11	8.10	6.10	4.20	6.20
Mon.	12	9.10	6.10	4.20	6.20
Tue.	13	10.10	6.10	4.20	6.20
Wed.	14	11.00 FQ	6.10	4.20	6.20
Thu.	15	12 00	6.10	4.20	6.20
Fri.	16	12.50 AM	6.10	4.20	6.20
Sat.	17	1.50	6.10	4.20	6.20
Sun	18	2.50	6.20	4.20	6.20
Mon.	19	3.50	6.20	4.20	6 20
Tue.	20	4.50	6.20	4.20	6.20
Wed.	21	No L.	No L.	4 20	6.20
Thu.	22	No L. FM	No L.	4.20	6.20
Fri.	23	No L.	No L.	4.20	6.20
Sat.	24	5.10 PM	8.00 PM	4.20	6.25
Sun.	25	5.10	9.10	4.20	6.25
Mon.	26	5.10	10.20	4.20	6.25
Tue.	27	5.10	11.20	4.20	6.25
Wed.	28	5.10	12.30 AM	4.20	6.25
Thu.	29	5.10 LQ	1.40	4.20	6.25
Fri.	30	5.10	2.50	4.20	6.25
Sat.	31	5.10	4.00	4.20	6 25

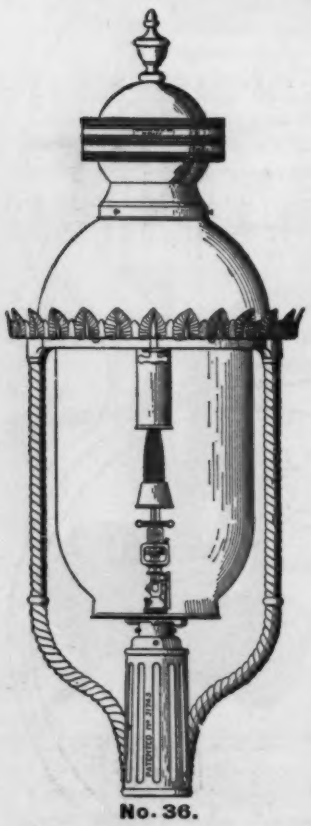
TOTAL HOURS LIGHTING DURING 1904.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	225.00	January	423.20
February	205.40	February	367.40
March	187.40	March	355.35
April	169.50	April	298.50
May	152.30	May	264.50
June	137.20	June	234.25
July	138.50	July	243.45
August	151.00	August	280.25
September	164.40	September	321.15
October	191.30	October	374.30
November	210.30	November	401.40
December	237.10	December	433.45
Total, yr.	2171.40	Total, yr.	4000.00

NEW YORK, 97 Liberty Street. BOSTON, 814 Beacon Building. PHILADELPHIA, Broad and Arch Streets. ST. LOUIS, 712 Roe Building. CHICAGO, Foot of Orleans Street. SAN FRANCISCO, 712 Polk Street.

WELSBACH STREET LIGHTING COMPANY

.... OF AMERICA ....



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No. 38.

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For the Period Ending July 31st, 1904, has been Awarded Contracts in the Following Places for

Standard Double-Superheater Lowe Water Gas Apparatus.

Augusta, Me.
Bangor, Pa.
Woonsocket, R. I. (2d contract).
Brooklyn, N. Y. (4th contract).
Cincinnati, O. (2d contract).
Scranton, Pa. (3d contract).
New York City (14th contract).
New Haven Conn. (2d contract).
Watertown, N. Y.
Tampa, Fla. (3d contract).
Westchester, N. Y. (3d contract).
Bridgeport, Conn. (2d contract).
St. Paul, Minn. (2d contract).
Harrisburg, Pa.
Pelham, N. Y.
Reading, Pa.
Springfield, Mass. (2d contract).
Lynn, Mass. (5th contract).

TOTAL SETS, 1904, ... 35
TOTAL DAILY CAPACITY, 1904, . . 50,400,000 cubic feet.
TOTAL SETS TO DATE, ... 543
TOTAL DAILY CAPACITY, . . . 413,180,000 cubic feet.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

Established 1858. Incorporated 1890.
CHAS. E. GREGORY, Prest. DAVID R. DALY, V.-Prest. & Treas.
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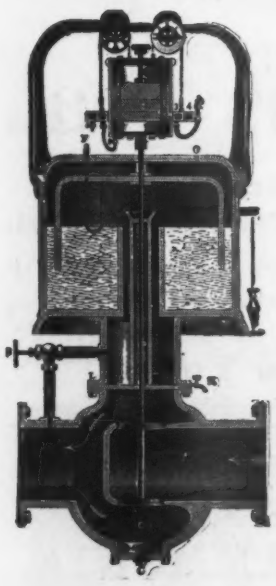

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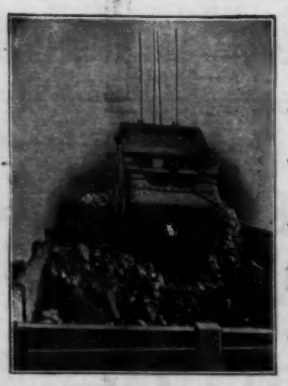

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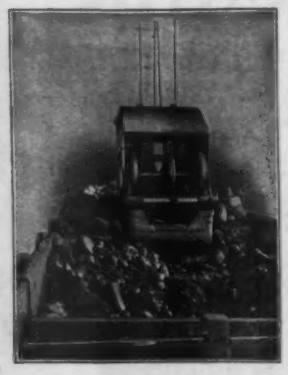

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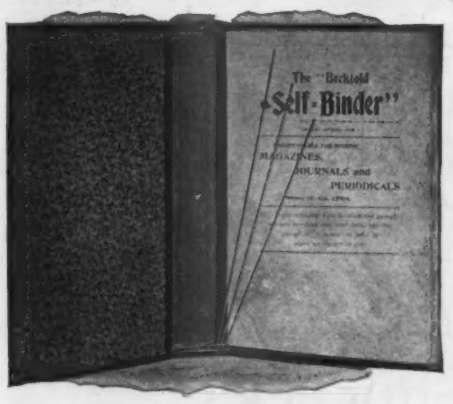

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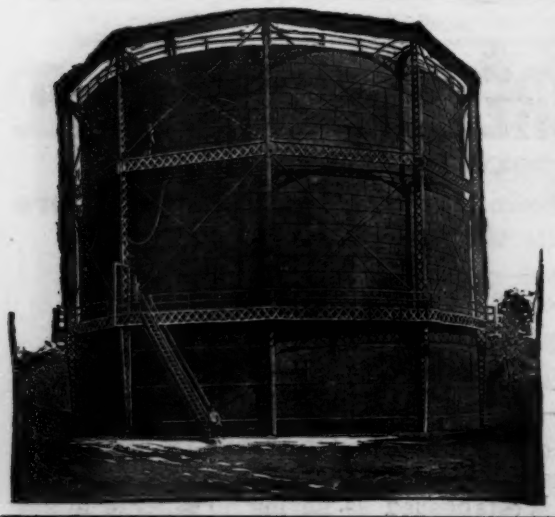

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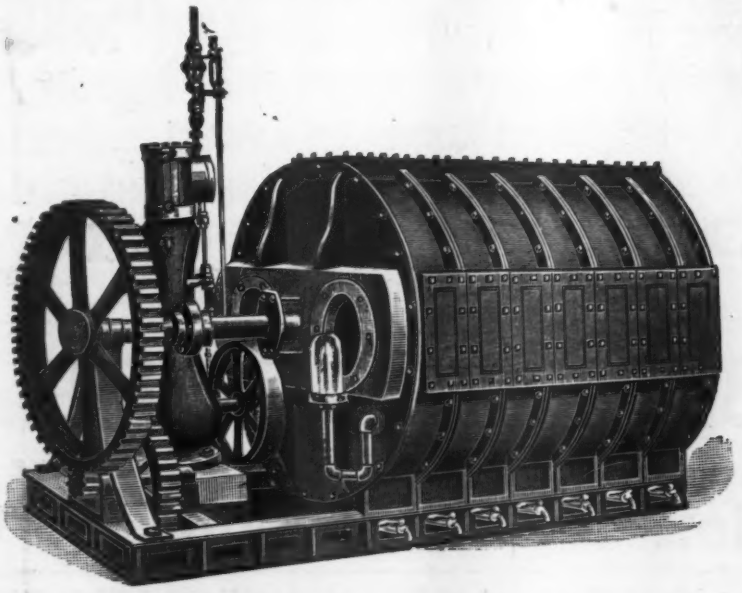

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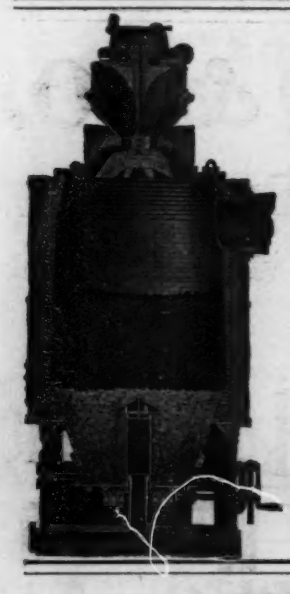

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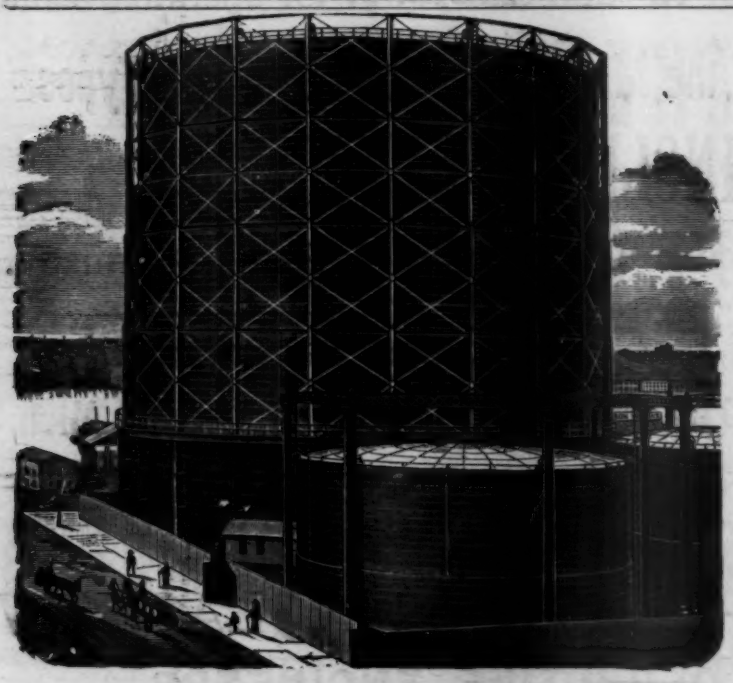

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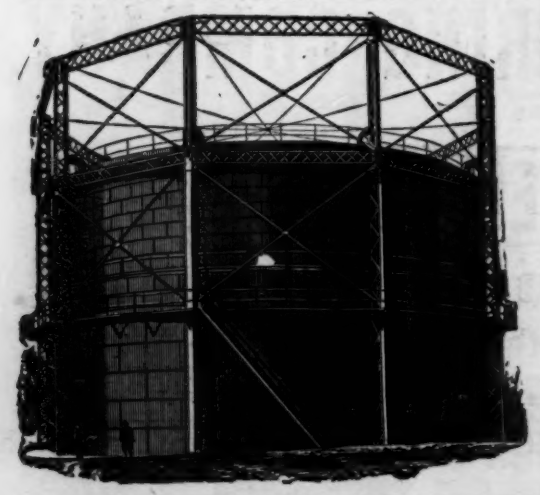

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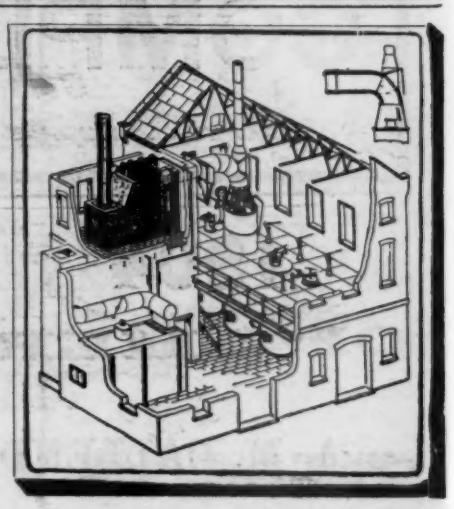

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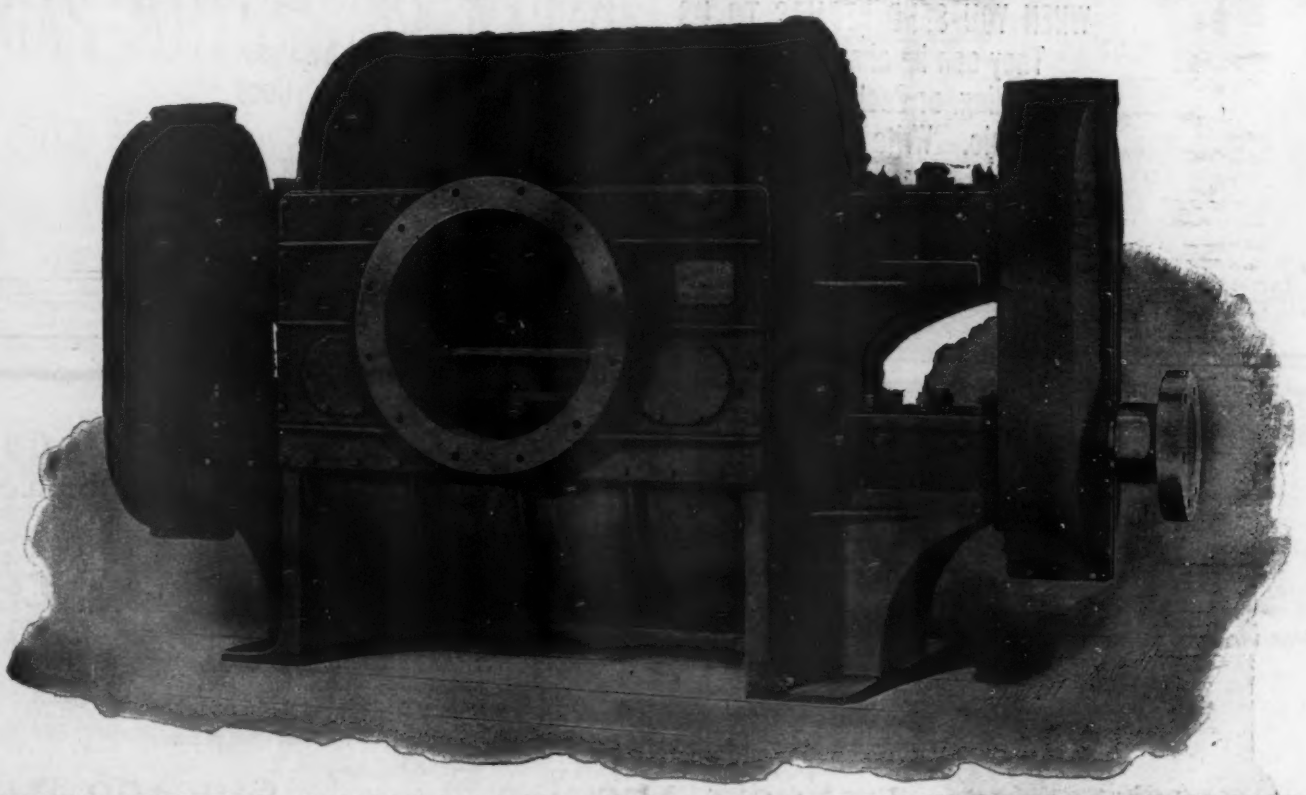

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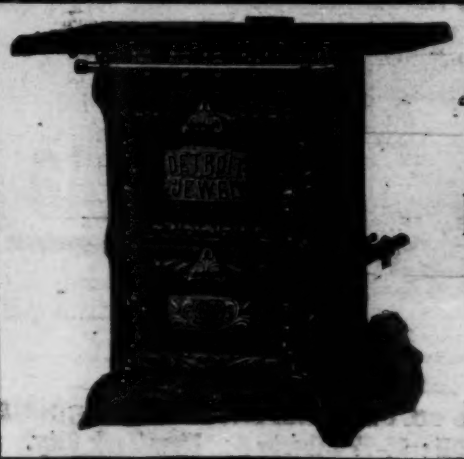

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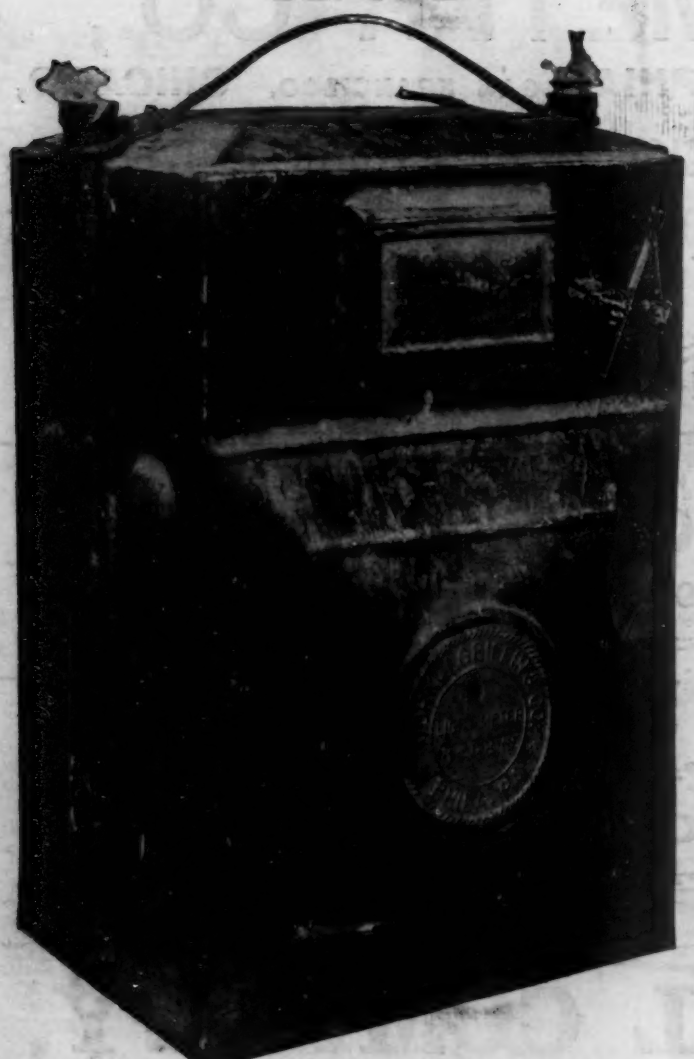

This is a photograph of a 3-light regular meter out of a lot of meters received from the Coatesville Gas Co., Coatesville, Pa., to be repaired and converted into prepayment meters.

AFTER.

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